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S Y S T E M

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OF

DISSECTIONS,

EXPLAINING THE

ANATOMY OF THE HUMAN BODY,

THE

MANNER OF DISPLAYING THE PARTS, AND THEIR VARIETIES IN DISEASE.

VOLUME THE FIRST.

CONTAINING

THE DISSECTIONS OF THE ABDOMEN, THORAX, PELVIS, THIGH, AND LEG.

THE SECOND EDITION.

BY CHARLES BELL,

FELLOW OF THE ROYAL COLLEGE OF SURGEONS.

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1799.

SYSTEM

DISSEMINATION

INFORMED BY THE

THE CHAIRMAN

OF THE



TO

DR. DANIEL RUTHERFORD,

PROFESSOR OF BOTANY IN THE UNIVERSITY OF EDINBURGH, AND PHYSICIAN TO THE ROYAL INFIRMARY,
Es. Es. Es.

THIS

FIRST VOLUME

OF A

SYSTEM OF DISSECTIONS

IS RESPECTFULLY DEDICATED,

BY

HIS OBEDIENT HUMBLE SERVANT,

CHARLES BELL.



P R E F A C E.

FOR the study of every science there are required such general views as may enable a student to take a lively interest in his pursuits, to direct his inquiries to the points of true importance, and to confirm in him a manly and steady resolution to persevere in learning the details and minutiae, which, although disagreeable and tedious in themselves, are yet absolutely necessary. In no case is this more indispensable than in the study of Anatomy; for the details are intricate, while the general result or economy, considered as a whole, is interesting and important. There are thus two departments of this science; both equally necessary, but to be studied in a very different manner.

What is detailed in elementary books of anatomy is too often represented as comprehending the whole of the art. Yet the object of such books is not practical anatomy; by which is to be understood the real investigation and knowledge of the dissected body. The descriptions are not adapted to the limited and successive views which, in dissection, we must have of the parts: they cannot be implicitly followed as guides; but, on the contrary, the anatomy of any part to be dissected, or of parts implicated in a great operation, must be collected from many different sources—muscles from one place, blood-vessels from another, and nerves from a third. The descriptions, too, will be found insulated and defective in such views as can give a lively interest, and a knowledge of the mutual dependence of the parts. Now elementary books should give simple, introductory, and connected views; but from this necessary arrangement, the descriptions cannot be immediately compared with the dissected body. For dissection is the study of anatomy in the detail, and, in books subservient to this study, more attention should be paid to the relative situation and contrast of parts, than to general views and rapid descriptions of the vessels or nerves of a limb; such more general and connected views are essentially necessary, but they are merely introductory.

That the common books are not suited to be assistants in dissection, every one must allow, who has taken the knife into his own hands, or been attentive to the operations in a dissecting room. He will know, that, in dissection, it is not the want of minute description that is so much felt, as the want of arrangements and plans upon which to proceed.—How often is it found, that young men, who have begun their anatomical labours with a true conviction of the importance of the subject, and with the most determined resolutions to combat all difficulties which might oppose themselves to their progress, have, for want of a plan and system of proceeding, gone to work in so disorderly a manner, that they have been soon bewildered, and forced, in despair, to renounce a pursuit, which, with their views better directed, would have been plain, and certainly most valuable to them.

The object of this work is to serve as an assistant to the student in acquiring a knowledge of Practical Anatomy; in gaining a local memory of the parts; in learning to trace them upon the dead subject, and to be able to represent them to his own mind upon the living body. This being my object, the method to be pursued is obvious: to give a short detail of the anatomy; to show how the parts are to be laid open, and how they are to be distinguished in dissection, or avoided in an operation; to give a short detail of the anatomy, and an arrangement adapted to the dissection; to explain the consequence of each part to the great functions of the body, and to mark the diseases to which it is liable.

For the execution of a plan of such importance, much allowance must be made: for it is a wide and difficult field; and the illustrations should be drawn from the whole range of the science.

In reviewing the subjects contained in this First Volume, I find them more deficient than should be expected from the lenient criticism I have met with. I find much wanting, much diffuse and irregular; and foresee more labour in correcting than in the first composing. But, I hope, it will be my excuse, that the nature of the work is such, that it can be made perfect only in the course of years, and by one, whose habits and duty give him the frequent opportunity of comparing it with the dissected body. I hope, afterwards, that it shall have a better claim to the title of a system of dissections, when I shall have arranged, and perfected, and concentrated, the descriptions, and reduced and adjusted the plates to a more uniform standard.

INTRODUCTION.

DISSECTION is not merely the management of the knife; there is required also a knowledge of the methods of injecting and preparing the parts, of investigating the structure of the viscera, and of presenting them for demonstration. For this reason I shall enumerate here the chief circumstances to be attended to as introductory to a common course of dissection, that they may be concentrated, and the anatomy freed from needless repetition. Practical Anatomy, like all arts in which an aptness and dexterity of the hands is necessary, is to be acquired not hastily, nor by precept; but an ease and certainty in its operations can be attained only after much assiduity and labour. All therefore, which is necessary at present, may be said in a few words; and I shall confine myself to the management of injection, and the means employed for facilitating the dissection and demonstration of minute parts.

Injection has been the great instrument in the hands of modern anatomists, and has led to many useful discoveries; but it is much to be regretted, that, like other subsidiary aids, this has often been abused, and its results too implicitly trusted to. Physiologists seem, indeed, to have claimed a privilege of supporting more extravagant theories, from the supposed proofs of injection. As in the experiments of Chemistry, a tyro in this art is more fruitful in discoveries, and new facts, than one who has known the accidents to which it is liable, and how the discoveries of one day, are overturned by the experiments of the succeeding. But this at least is satisfactory, that, in spite of every disadvantage, the art of injection has contributed to the rapid advancement of our surgical knowledge.

To those who are commencing their operations, small subjects will be found the most convenient, being more easily managed, and not likely to embarrass the student with much confusion. Besides, his views at first should not be so immediately directed to practice; his object should rather be to acquire general ideas of the anatomy. Young subjects are likewise much fitter for injection (I mean for the injection of the arteries, and for minute injection): they are not only more easily heated and managed, but, what is of more consequence, their blood-vessels have an elasticity and strength which enables them to bear the push of the injection better, and, by a kind of elastic resistance, to give warning of the danger of rupturing their coats; while, in old bodies, the piston of the syringe goes easily down so far, stops, and, if forced, most probably bursts the vessels, driving the injection amongst the muscles, and giving much trouble in the dissection. When any of the trunks burst in this way, the tension being taken off, their coats contract upon the warm injection, and they remain half filled.

In old age, this want of pliancy becomes very remarkable. There is often a kind of stiffness and rigidity, as if the coats of the vessels were corrugated; a degree of that state in which we find the arteries when ossified, or when concretions are formed in their coats.

If only some coarse injection is in a slovenly manner to be thrown into the great vessels to show their course, it does not much signify how it is done, or what injection is used, or what means are employed to facilitate the passage of the injection. But if the vessels are to be injected minutely, it is necessary previously to heat the subject well, by bathing it in warm water, or applying steam to the surface. This is of more consequence than even the choice of the subject; for, as the injection is intended to be penetrating and fluid when warm, and, upon becoming cold, to congeal and remain solid in the vessels, it is necessary that the vessels be heated, that they may not suddenly chill the injection: besides this heating

of the body softens and relaxes all the mass of flesh, and brings it to a more suitable state for admitting injection. But it ought to be remembered, that, if the parts be overheated, especially where the vessels to be injected lie exposed, there is danger of spoiling all, by corrugating their coats, and making them quite friable and tender. There is a better way still of heating the subject; viz. by heating the vessels themselves: and, indeed, the two methods should be always combined.—The common practice in the injection of the great vessels, is, to inject first equal parts of brown and white spirit varnish, coloured with the same paint that is used for the coarse or wax injection; and this fine varnish injection, being moderately heated, and thrown in before the wax injection, clears its way, and moderately heats the vessels, so that they do not readily cool or retard the wax injection which is to follow. But when using minute injection (which is size coloured with vermilion) for the purpose of demonstrating the minute vessels, although the hard injection is thrown into the vessels after it, simply to stop the regurgitation of the warm and liquid size, and to retain it in the minutest extremities of the vessels, yet it infallibly happens that the wax injection runs more minutely in this way than in any other. This being the case, it will be found, in all cases, to be a better method to use painter's size, coloured with vermilion, and heated, but not so much as to crisp the vessels; and to throw it in before the coarse injection. It is the least expensive, runs more minutely, gives always a chance for beautiful specimens of minute injection, and can be pushed to any quantity, even till the skin of the limb becomes quite tense, without rupturing the vessels, or those vessels at least by which the coarse injection can escape. By this means, the vessels are dilated, the limb made warm and moist, and the wax injection flows easily into the arteries, whilst the size escapes with the slightest pressure into the cellular texture.

I have seen great care taken to exclude air and water from the arteries previously to the injection, lest they should retard it, or break its continuity in the arteries when cold: but often, upon an emergency, equally good injections of the arteries may be made by throwing in abundance of warm water before the wax. This, however, is not a practice generally to be followed; but it shows that it is rather a mixture of water or air along with the injection in the syringe, which is to be avoided; for, in that case, they will certainly be mixed in the vessels; which will be found, upon cooling, with the wax broken and interrupted in them.

In the veins, on the contrary, if there be any air or water in them previously to throwing in the injection (at least in the extremities, where, on account of the valves, it is necessary to inject from the branches towards the trunks), the injection is then confined to the great vessels; and the air or water, not being allowed to escape by exudation, must remain interrupting the wax. The most effectual way of avoiding the mixture of air with the injection in the syringe, is, after having drawn it full, to hold up its point. This allows the air to rise to the top; and before introducing the nozzle of the syringe into the pipe, the piston should be pushed gently, till the injection appears at it.

The success of the injection of veins depends entirely upon their being well washed with warm water, and repeatedly dilated, as they are for the most part foul with coagulated blood, especially in old people; although, in other respects, the veins of old subjects are in the best state for injection, being enlarged and varicose. The coagula must frequently be drawn out of the mouths of the larger veins before introducing the tube. If the veins of the thigh and leg, for instance, are to be injected, the tube should be fixed in a small vein upon the fore part of the foot, near to the great toe; and a stop-cock should also be fixed into the external iliac vein, within Paupart's ligament. Then the blood must be washed out by throwing in tepid water from the tube at the toe; first, with the stop-cock open; and afterwards, when the veins are a little cleared, the stop-cock at the top of the thigh is to be stopt, and the veins a little distended, and the limb immersed in warm water. Before injecting, the veins must be completely emptied by opening the stop-cock, and stroking up the thigh. The coarse injection should be thrown in while the limb is thus completely warm, and without any fine injection being thrown in before. During the

injection, the stop-cock at the groin should be kept open, and some one placed to turn it when the injection appears at the mouth of the vein.—In this way, the air or water will be driven freely before the injection; and veins, which would otherwise remain empty, will be filled; for, by the dilatation, the valves lose their power, become too small for the diameter of the vessels, and allow the injection to go backwards into the branches.

In filling the arteries with coarse injection, when extravasation or rupture of the vessel happens, it seems strange that the rupture is commonly in the trunk, and not in the smaller branches, since we know that the strength of the larger vessels is owing to their greater elastic resistance, whilst that of the lesser arteries arises from their muscular power, which must cease in the dead body. But there is an evident reason for this: The rupture of the arteries often happens from using the injection too hot; and as the great heat of the injection is in part corrected before it gains the extremities, they are not affected by it; while the root or trunk of the vessel being perpetually exposed to the hot stream, its coats are corrugated, and consequently burst. Besides, as the injection, when it cools, plugs up the smaller branches, the force of a heavy and unwary hand is exerted upon the trunks, where, the injection being yet fluid, they are dilatable. Accordingly we find, that, in throwing in cool and fine injection, the rupture is always towards the extremities.

From all this it may easily be understood why at first the piston is to be pushed slowly and gradually whilst throwing in the fine injection; insinuating the fluid into the more delicate vessels, which are very easily ruptured; scarcely pressing at first, but allowing the piston to go down with its own weight, and gradually increasing the force. The coarse injection again is to be thrown in with a smart push. This is the great delicacy in injection; and to accomplish it without danger of rupturing the vessels, is to be acquired only by practice.

There are still other things which require attention; viz. the tying of all collateral vessels that may have been opened, and the fixing of the tube securely in the mouth of the vessel. When the injecting pipe is introduced into the vessel, it cannot be retained there by a simple knot, without a chance of its slipping off during the injection, or, if tied firmly, of cutting the coats of the vessel. Therefore, after the ligature is drawn upon the artery including the tube, the ends of the ligature should be brought over the wings of the tube, and then carried round so as to include that part of the ligature which reaches from the mouth of the tube to the wing; and being tied there, the former knot is tightened, and the mouth of the artery drawn up upon the barrel of the tube.

The coarse injection is composed of the following ingredients:—Bees wax, six ounces; resin, eight ounces; turpentine varnish, six ounces. The wax and resin give hardness and consistency; and the varnish is added to give it pliancy. These colours are generally used: Vermilion, king's yellow, flake white, smalt, verditer, verdigrise, lamp black. They should be mixed with the turpentine varnish, and then added to the wax when melted; and should there be occasion to melt the injection a second time, the heat must be cautiously applied, lest the colours should be burnt and destroyed. The injection should not be thrown into the vessels while too warm, for it will hurt their coats. The degree of heat should be such, that the finger can be allowed to remain in it for a little while.—A coarser composition may be made with tallow, wax, spirit of turpentine, and oil, coloured with the coarser paints; or, simply, tallow and red lead, when the parts are not to be preserved. And for minute injection, turpentine, coloured with vermilion, (which Haller preferred to all other injections, for running minutely, and without extravasation); painter's size, coloured with any of the above paints; or equal parts of brown and white spirit varnish.

It has already been observed, that the limbs, or any part of the body, are easily dilated by the minute injection, in consequence of its escaping into the smaller vessels. This must in some measure be prevented when it is intended to display the minute vascularity of membranes and joints, and more espe-

cially the vascularity of bones ; for while the injection freely escapes into the dilatable cellular membrane, it will never penetrate into the more resisting parts, as the bones and cartilages. Therefore, when a minute injection of the bones and cartilages is intended, a bandage must be rolled from the toes to the upper part of the limb, not very tight, but so as to restrain the enlargement of the muscles and cellular membrane by the force of the injection. In this way, the minute vessels are filled, yet little extravasation allowed ; for there is an equal resistance in the soft parts and in the bones, and the parts partake more equably of their natural proportion of the colouring fluid. By this precaution, I have been enabled to inject the bones very successfully, showing all the stages of ossification. And not in sound limbs only, but in cases of diseased bones, with open ulcerated surfaces, I have succeeded in the injection, by firmly bandaging the limbs ; when, otherwise, the injection would have readily escaped, and important morbid preparations have remained useless.

Although the great difficulty of preparing the bones lies in the injection of them, yet much remains to be done in making them transparent, that their vascularity may be shown ; in the manner of cutting the cartilages to show the progress of ossification ; and there is even some difficulty in exposing their texture, independently of their vascularity, as by erosion, burning, and maceration. Very young subjects are better for showing the vascularity of bones. But by this it is not to be understood that the vessels of bones are more numerous at their formation than at their full growth ; for the natural bony structure of the body is always liable to be absorbed, and therefore must be profusely supplied with secreting vessels, so as to be still within the action of the system. Were this not the case, their absorption would be marked by their total decay, instead of the bone being perpetually renovated. Therefore the vessels must be as intimately distributed in the interstices of the bony matter, and as capable of their functions in a full-grown bone as in the bone of a child.—In extreme old age, we are to understand, from the writers on the subject, that the vessels are contracted and obliterated, lost in the increasing proportion of the osseous deposition ; but when an artery loses its functions, the parts to which it belongs are dead, and out of the living system ; and if it happen that bones, unsupplied with vessels, remain enveloped in the living parts, it seems at least to be contrary to the prevailing laws of the economy, as a part, when dead, is thrown off from the living surface.

The minute vascularity of a bone is to be shown, after injection, by a long maceration of it in diluted muriatic acid ; which, by dissolving the earthy part of the bone, leaves the fibrous part (in the interstices of which the earth was deposited) flexible, and without any character of bone but the form. In this state, it is like cartilage, soft and yielding, but apparently fibrous : but the vessels will still be no more discernible than before. The bone is to be thoroughly dried, and then plunged into a glass of clear spirit of turpentine ; when, as soon as the spirit penetrates the cells, the bone becomes quite transparent, and the vessels easily distinguishable, branching through its substance.—In corroding shells to show the glutinous basis in which their earthy part is laid, spirit of wine, with a little of the acid dropt into it, has been used, by which the delicate web is preserved, whilst the other parts are taken away. In the same manner, in the maceration of bones, when the maceration is expected to be tedious, it may be necessary to add spirit of wine to the menstruum to prevent the size in the vessels from being resolved and washed away.—The most beautiful preparation of bone is the simple section of the cartilage, or apophysis, in young subjects, where the injection has run minutely, and while the nucleus of bone is still small and red with injection. This nucleus is seen lying in the middle of the cartilage, with the vessels crowding from the surface towards the centre, and terminating in the bone ; or perhaps only a small and delicate artery is seen pushing into the centre of the cartilage, and terminating in a point the beginning of a future bone. The cartilages in this state, when cut in thin slices, and suspended in spirit of wine, are beautiful ; or when those slices are dried, and suspended in spirit of turpentine, the cartilage becomes so transparent, that it is with difficulty discerned in the fluid, and nothing is seen but the nucleus of bone, with the arte-

ries beautifully ramifying to supply it : Or the nucleus of bone may be tinged by solutions of some of the metals in acid, while the cartilage will remain perfectly white. Such preparations may be infinitely varied, forming the most beautiful examples of the changes going on, not only in the bones, but, by analogy, in the whole body.

The marrow, also, may be displayed, after injection, by maceration in water ; or by flitting up the cylindrical bones, and preserving them in spirit of wine. When such a section of a bone is dried, and put in oil of turpentine, the vessels supplying the marrow bags, being collapsed to the side of the bone, are seen in great profusion.

The structure of bone is demonstrated, independently of injection, by maceration and burning. By exposing bones gradually to a red heat, and so placed that they may be equally supported, the animal part is burnt away, whilst the earthy part remains behind, a calcareous phosphat, retaining the figure of the bone, but deprived of its gluten and fibrous part, which gave it strength. This is just the reverse of what takes place in the corrosion with the muriatic acid. In the one case, the animal fibre is burnt away, leaving the secreted bony part in its original figure ; in the other, the calcareous or osseous part is dissolved in the acid, the softer parts (which, when endowed with living properties, were capable of secreting this earthy part from the blood) remaining undissolved. These preparations, therefore, should be contrasted.

If a bone is burnt, and then put in acid, it is entirely destroyed. If, therefore, after burning it completely, warm wax be poured into its cavity, and it then be corroded in acid, the cells will be elegantly cast in wax.

Corroded preparations are the most elegant of all, requiring great care. They are generally made of the injections of the solid viscera ; as the heart, lungs, liver, kidney, and spleen. Harder injection than common is required for these, and no minute injection need be thrown in before. If the injection succeed, the only other delicacy is to place the preparation while the injection is yet warm, as it is intended to remain, and where the corroding acid may be easily applied. When the fleshy part is dissolved, it is to be gently washed away by the agitation of the water ; and it should not be attempted to be lifted out of the water till entirely freed from the parenchymatous matter, which, by its weight, might break the delicate branches. The menstrua are the muriatic and nitric acids ; the latter of which M. Sue found a more perfect menstruum, and less apt to affect the colours of the injection, or the minute vessels.

Compositions of glass may also be used in making casts of many parts, as they admit of a great variety of transparent colours ; the soft parts and the bones being burnt away, while the paste is acquiring its glassy surface.

In preparing morbid parts, there are often appearances, curious and important, which cannot be preserved. Often, in examining the parts, the colour is the only criterion by which the nature of the disease is to be determined ; and this it is often impossible to preserve. Recourse must be had to painting, to give the lively tints which alone remain of the disease, &c. But even here injections may be of much service, as a means of making the parts more beautiful or natural, and more extensively useful, by unravelling that intricacy which is so often found in wet preparations having no discrimination of colour. Even in organic affections of the heart, lungs, intestines, &c. injection gives a splendour and consequence which the real importance of these parts would perhaps claim in vain ; and in preparing such parts, great expertness may be acquired in giving them natural or beautiful tinges, by injecting the vessels with coloured fluids.

In preserving thick fleshy parts in spirits, it will be sometimes necessary to inject spirits into their vessels ; which, thoroughly pervading them, tend greatly to preserve them. Liquors for preserving preparations have been much boasted of since the time of Ruysch ; but to clean and unadulterated spirit of wine

there can be no objection. It must, however, be diluted according to the delicacy of the parts to be immersed in it. Sometimes, when very delicate fleshy membranes are put up in pure spirits, they will be found next day shrivelled and shrunk up to the top of the jar: but by saturating the spirits with fugar, they lose this property, and the membrane hangs loosely in the jar. The glasses containing such membranous parts should be allowed to stand some time before being finally closed: for though the membrane, being full of water when first put into the spirits, hangs elegantly enough; yet, when it has parted with its superabundance of water, and received the spirit, it will become so light, that it will swim upon the surface, and require little hooks of glass to be put to its lower part to weigh it down.—Wet preparations often require to have the spirits changed upon them several times before they are finally put up; to prevent the possibility of their tinging the spirits after they are closed; or, perhaps, it may be necessary that the parts should be stuffed, or held out in particular postures, till they be so hardened, that they may remain unsupported in the jar. For this purpose, diluted muriatic acid and nitrous acid combined, is sometimes used; or the diluted nitrous acid simply; or a solution of alum and common salt. These give the parts firmness and strength to support themselves in the glass. Care must always be taken to macerate the parts well previously, and to free them entirely from blood.

When delicate membranes are to be injected either with quicksilver or with fine size, instead of tying all the vessels by which the fluid may escape, I have found it necessary only to sear the edges of the membrane with a heated iron; or, after having fixed the tubes, the common method is to dry the edges all round, while the middle part is kept soft and moist. When it is required to demonstrate the vascularity of a part where there is no opportunity of injecting it, if membranous, the blood may be detained in the vessels by quickly drying and varnishing it. The blood, when extravasated, or when (as in the piles) preternaturally collected in vessels, may be coagulated by a solution of alum; or blood inflamed parts may be coagulated by distilled vinegar. In other instances, as in preparations of the lacteals, their natural fluids may be coagulated and preserved by plunging them suddenly into strong spirits.

There are many parts of the body which it is impossible to keep for any time in their original beauty, and these the most delicate and interesting; as the organs of the senses, and all minute nervous parts, the villi of the intestines, the comparative anatomy of insects, the incubated egg, &c. The ready demonstration of such delicate parts in the fresh subject is the truest test of the abilities of the practical anatomist; for there is more delicacy and nicety required in exposing these parts, and more real benefit to be derived from them, than in making the more lasting preparations.—The minute structure of many of these parts must be dissected and unravelled under water, where the loose and floating membranes display themselves; while, out of the water, they would lie collapsed and undistinguished. In such investigations, I have found nothing of so much service as jelly made strong and quite transparent. When a delicate part is completely dissected (suppose it to be the coats of the eye), place it in the jelly as it is becoming firm, and hold out the parts; and they will be retained, elegantly displayed, either for demonstration or for drawing.

In some instances (as in dissecting the eye and ear), freezing mixtures have been employed, which allow the frozen parts to be dissected without the fluids escaping. It is not always with the knife that we must expect to dissect and separate the minute and transparent organs, but frequently the object is best attained by blowing betwixt the lamina; as of the pia mater, the capsule of the lens, the cellular coat of the intestines, &c.

Boiling and maceration are often employed to demonstrate the muscularity of parts; as the course of the fibres in the heart. The course of the fibres in the bladder may also be shown, by distending it, and plunging it suddenly into boiling water. In this way, also, the coats of arteries, the rete mucosum of the skin, &c. may be demonstrated. Immersing the skin in boiling water before injection, is said to

make the villi stand out more from the surface. Although immersing in boiling water will not separate membranes into their layers, sometimes alternately macerating them in cold and warm water will do it, or macerating till putrefaction takes place, and then plunging the part into boiling water, as is done to separate the cornea.

Boiling gently with a solution of nitre and alum is used to render evident the muscularity of membranous parts. The solution makes the muscular fibre of a red colour: but, perhaps, minutely injecting the parts is a more natural and effectual method; for, after a successful injection, the muscular fibres of the bladder, for instance, being very vascular, become distinguishable.—Nervous membranes, as the expanded nerve of the eye and ear, the septa of the vitreous humor, and the membranes of the egg, become opaque when vinegar is poured upon them. Without this, the latter cannot be distinguished.

The brain and nerves, by being exposed to the oxygenated muriatic acid, are made firm, and brought to a better state for dissection. In short, there is a great field for ingenuity in this kind of investigation:

Lately many discoveries have been made, and much written upon the subject of absorption, and the structure of the lymphatics; and the disputes and wranglings about quicksilver injection has entailed a degree of consequence upon it, which, perhaps, it does not merit, either from the comparative elegance of the preparations, or from its use in fitting students to pursue their more important studies. Yet such is the fascinating power of the examples which have been given, that I have seen many students who could attend to nothing else; till, poring over the subject in search of lymphatics, they have dreamt the greatest absurdities in the way of discovery. The doctrine of absorption has been brought to its present consistency by the labours of a few ingenious men; and luckily, while hypotheses have been forming, the mechanical dexterity in their demonstration has been brought to its present perfection. Upon this last subject there have been treatises written professedly; and much scattered information will be found in the pamphlets of Dr. Monro and Dr. Hunter,—in the writings of Hewson, Sheldon, and Cruickshanks. As these are books which every person reads who wishes to be acquainted with the opinions respecting lymphatic absorption, and the facts upon which so much of the modern physiology is founded, it would be needless for me to give any details here.

As to the manual operation of dissecting, there can be little said. To hold the knife easily in the hand, not rigidly,—to lay the edge fairly to the part,—and to cut with a steady and uniform stroke, has a good appearance: but the best rule in this, and all such operations, is, to avoid all affectation of manner.—In dissecting muscular parts, the uniform rule is, to dissect always in the direction of the fibre; and, in lifting the integuments, to push the knuckles so behind them as to stretch the cellular membrane, which connects them with the muscle. The knife is to be kept close to the muscles, and carried in the length of the fibres, separating a fasciculus of them at each stroke. By this means, what is dissected will be fair and clean, and the direction of the fibres will be distinctly shown: on the contrary, to dissect a muscle by first taking off the integuments and then cleaning it, bit by bit, will be found a very tedious and irregular operation. Yet it must be remembered, that, in proceeding in this manner with muscles having fascia and aponeurosis coming off from them, there is some chance of taking away these in part along with the mass of the integuments; and when minute vessels are to be dissected, it is impossible to take the integuments thus off at once: the cutis only must be taken away, and the cellular membrane left to be dissected more cautiously from betwixt the vessels.—In no dissection should any more of the integuments be taken off from a part than is necessary at the time; and, upon any interruption, the integuments should be carefully replaced; for, when dissected parts are left open, they contract a mucus, or become dry and unseemly.

The scissors are too little used in dissection, as the use of the knife is supposed to make good operators: but it is always of more importance to be well acquainted with the parts which should be cut, than to display too great a management of the knife.

From what I have seen of private dissection, I would rather advise those who are desirous of undertaking a complete course of dissections, not to begin their labours with learning all the muscles of the body; for this, besides other disagreeable circumstances, is a dry and tedious task at first.—It will perhaps be found more truly useful to begin their dissections with general views to the economy of such parts as, from lectures or books, they know to be of importance; then proceeding, in a more determined way, to study rigidly the anatomy of the bones and muscles, and accidents of the great joints,—the blood-vessels and nerves, and the anatomy of the great operations of surgery.

During dissection, there are many little operations which should be practised, and which are neglected. The introducing, for example, of probes into the ducts; as into the nasal duct, and into the ducts of the salivary glands: the introducing of instruments into the nose and throat, and into the Eustachian tube: the use of the probang, and of the catheter, &c.—Knowledge and dexterity in such points often prove more useful, as being oftener required, than the greater operations of surgery.



A SYSTEM OF DISSECTIONS.

PART I.

CONTAINING

THE DISSECTION OF THE ABDOMINAL MUSCLES AND VISCERA.



A

S Y S T E M

OF

D I S S E C T I O N S.

DISSECTION

OF THE

ABDOMINAL MUSCLES.

THE dissection of the abdominal muscles is often the first that a student sees; and if it be carefully done, he is astonished to find the fleshy mass of the body separated into so many distinct parts, and is pleased with the appearance of the muscles exposed in all their beautiful variety of shapes and colours, the smoothness of their surface, and their silvery expanded tendons. But he conceives all this to be the simple exposition of the parts, not the effect of persevering labour; and if accustomed to the clear demonstration of a class dissection, has no idea of difficulty in the task. He feels the difficulty of dissection only when he takes the knife in his own hand, directed by that vague knowledge alone, which is, I fear, too common, and which consists more in a facility of repeating descriptions, than in a precise and clear idea of the situation of the parts. To begin a course of private dissections with such light ideas of the difficulty and importance of the task, and so poor a knowledge of practical anatomy, must produce in the student that disappointed and irritated state of mind which is but ill calculated to carry him on with perseverance. He will find that there are many little observations to be made, and much accurate knowledge to be acquired of the appearance of parts, of vessels, of cellular substance, fascia and tendons, before he can go on confidently, and be sure of the course of his knife.

No dissection ought to be begun without maturely considering the parts which lie concealed, and all that is most worthy of labour. Following this method, I shall first describe the general outline of the parts to be dissected; and, secondly, the order of the dissection, and the points that ought to arrest attention.

FIRST STAGE OF THE DISSECTION.

In the first dissection there is only one muscle on each side of the belly to be dissected; for the outer oblique muscle covers all the others.

The *OBLIQUUS EXTERNUS ABDOMINIS* arises by triangular fleshy slips from the lower edge of the eight lowermost ribs, (Plate I. Fig. 1. A.); its muscular fibres proceed downwards obliquely over the cartilages of the ribs, and also obliquely downwards over the free space (B) betwixt the borders of the chest and the spine

of the ilium. Terminating its muscular part abruptly, it sends its expanded tendon (a b c) over all the fore part of the belly, and is inserted into the spine of the ilium (n), into Poupart's ligament (o), into the os pubis, and into the whole length of the linea alba (a a a), which is only the interlacing of this with the tendon of the muscle of the opposite side.

DISSECTION.—Making an incision through the integuments from the sternum to the os pubis, and crossing it with another passing immediately below the umbilicus, and round the side in the direction of the curve of the ilium, the lower flaps are to be dissected from the lower part of the belly, laying them over the thighs—and the upper flaps, when dissected, are to be laid over the breast. In doing this, you perceive that you have two very different surfaces to dissect. 1. The muscular fibres of the obliquus externus, lying on the side betwixt the ribs and ilium (B); and the thin layers of its fibres (p) which lie upon the surface of the thorax, and which are very apt to be destroyed in first lifting the integuments; and, 2. You have to dissect the expanded tendon on the fore part of the belly (a b c). In dissecting the muscular part, you will find it covered by a thin expansion; adhering closely to the fibres—and if you take the fat and integuments off, leaving the muscle with the cellular substance and slight aponeurosis adhering to it, you will never make a clean muscle, however carefully you afterwards dissect it. You are therefore to carry your knife close to the surface of the muscle, and to disentangle its fibres from the membranous covering and integuments, by long and equable strokes, carried in the direction of the fibre. This is the method which you ought to pursue in all muscular dissections, when there is no fascia to be exposed, nor branches of injected vessels to be avoided. But you are not to proceed in the same manner in the tendinous and fore part of the abdomen, at least in your first attempts; for you would be in danger of lifting the outer layers of this sheet of tendon of the external oblique muscle, and, led away by the appearance of a beautiful shining surface (which may be the tendons of the lower layer of muscles), destroy the beauty of the parts, and make confused and irregular work. Therefore take off the integuments in a mass from the fore part of the belly; and when you see all the general surface exposed, you cannot proceed far in dissecting off the condensed cellular substance from the surface of the tendon, without observing the confusion into which such irregularity will lead you.

In the course of the dissection of this single muscle, all these points must be minutely attended to—the LINEA ALBA (a a a)—the LINEA SEMILUNARIS (b b b)—and the ANATOMY of the RING (d).

To understand these lines which divide the tendon of the external oblique muscle, it is necessary to remember the situation of the RECTI MUSCLES*. They reach from the sternum to the os pubis. Each arises from an extensive adhesion (q) to the outer surface of the sternum, and to the cartilages of the ribs, and proceeding down in the middle of the belly, included in an appropriated sheath, is inserted into the os pubis. This sheath is stronger upon its outer part, because when the body is strongly bent forwards, and the surface of the belly is concave, the recti muscles, were they held only by the elastic skin, would start from their places, and make a direct line from the sternum to the pubis; but this strong sheath in which they are included, being composed of the tendons of the broad muscles, bends as they bend, and consequently the recti acting thus in a curve, act more powerfully in drawing the thorax towards the pubis. The sheath of each rectus muscle, as I have said, is formed by the tendons of the flat muscles of the belly, proceeding from behind forwards. These, when they reach the side of the rectus muscle, mingle their tendons more intimately together, which appears externally as a white semilunar line (b b b) running round in the direction of the skirts of the rectus muscle—and these broad tendons splitting again, include the rectus in their duplicature, and meeting beyond that muscle, form the tendinous white line in the middle of the belly called the linea alba (a a a). The rectus muscle does not run unconnected in this sheath, nor does it form one continued tract of muscular fibre; but the intermediate tendons

* The rectus muscle of the right side is seen, Plate I. FFF. On the left side, the rectus muscle may be distinguished through the expanded tendon of the obliquus externus.



which divide it into square muscular portions (F F F) are firmly connected with the sheath, while the muscular part adheres to it by loose cellular substance. Therefore when the external muscle of the belly is carefully dissected, you can distinguish these parts: *First*, The origins of the muscle from the side of the thorax, coming down in thin layers over the ribs (A p). *Secondly*, A stronger and more fleshy part winding round the side betwixt the false ribs and the ilium (B). Then the expanded tendon on the fore part of the belly divided by the linea alba (a a a), which is in a direct line from the pubis to the sternum, and the linea semilunaris (b b b), running up from the os pubis in a curved line, a little to one side. In the space included betwixt these two lines, you may observe indistinctly the rectus shining blue and livid through the transparent tendon of the oblique muscle, and intersected with white interfices or ribs formed by its intermediate tendons as seen on the right side (c c c).

THE RING.—But the most important part of this first dissection still remains to be described, viz. the anatomy of the ring. When dissecting the lower part of the abdomen near the pubis, you find the fibres of the tendon coming down obliquely to be inserted into the ligament of the thigh; and indeed the ligament of the thigh (o) is nothing but the strengthening of the tendons of the external and internal oblique muscles at this place, where they pass over from the ilium to the thigh, are continued into one another, and form a ligament which allows the vessels of the thigh (f g) to pass freely out from the belly. Dissecting still nearer the pubis, just as the tendon is about to be inserted into that bone, you see it splitting (at d) and allowing the spermatic cord (e) to slip through its fibres,—and then meeting again, its fibres cross each other, and are at the same time firmly implanted into the crest of the os pubis—Continuing to dissect the integuments off these parts, and a little down upon the thigh, observe the situation of the femoral artery (f)—of the epigastric branch (i)—of the spermatic cord (e)—and all the parts implicated in the femoral and inguinal hernia. (See further of the anatomy of the femoral ligament, in that part of the work which contains the dissection of the thigh).

In taking off the skin from the groin, you find a confused and irregular aponeurosis coming off from the abdomen, and going down upon the thigh, apparently made up of, or strengthened by, the close intermixture of cellular substance. At this part you find it covering the femoral artery; the inguinal glands (h) lying without it, and the vena saphæna major sinking through it to join the femoral vein. You find also, where the thigh is injected, the small arteries rising perpendicularly from the great trunk, to supply these glands, and the other superficial parts. This irregular aponeurosis being in the femoral hernia matted and condensed by inflammation, forms a coat, which must be cut through before the peritoneal sac is opened.

After dissecting and observing the natural texture and situation of this aponeurosis, and its probable changes in disease, sacrifice it to a more important demonstration, or leave it on one thigh, while you proceed with the dissection of the other. Thus, taking away these confused parts, expose neatly the ligament of the thigh. Dissect the artery and vein in the angle of the groin, where they lie imbedded. Then, dissecting delicately with your scissors, under the ligament, you find proceeding from the upper part of the femoral artery, two branches; the arteria circumflexa ilii (k), and the epigastric artery (i). The first of these you find running back along the inside of the ligament, towards the ilium, to inosculate with the ilio-lumbar artery; the latter is the more important, the epigastric artery. You may observe the direction of its course (in Fig. 2. it is marked by a dotted line, as it lies under the muscles); it runs up upon the inside of the tendons of the abdominal muscles, making its way to the rectus muscle, on the inside of which it climbs, even till it inosculate with the internal mammary, which is the first branch of the subclavian artery. In this course it crosses the upper part of the ring, and crosses the spermatic cord. Now, you observe that the femoral hernia, coming down on the inside of the femoral artery, the epigastric artery and the spermatic cord must pass before the neck of the sac, so as to hinder the free incision of it when strangulated; and you see how difficult it must be to cut thread by thread exactly in the middle point betwixt the epigastric artery and the cord, especially when

you recollect how different the appearance of these parts is in hernia, after continued inflammation. You may observe the relative situation of these parts in Plate I. Fig. 2. A, the gut; B, the epigastric artery; C, the cord.

These are parts of such importance, that you ought to consider them in every possible light. You see that the direction of the inguinal hernia must follow the course of the cord, that it will be nearer to the pubis, and higher up: that the seat of the femoral hernia is in the flexure of the groin; and that if the hernia is not very large, and the parts swelled, the ring, and the cord from the ring to the testicle, should be free. You have to observe how the arch, which is formed by Poupart's ligament, over the vessels and muscles coming from within the belly, is filled up with fat and cellular substance, and how the vessels lie imbedded in it. You find the vein lying more towards the pubis than the artery, and the small inguinal branches of the artery rising to supply the inguinal glands; these arteries sometimes bleed profusely in opening buboes in the groin.

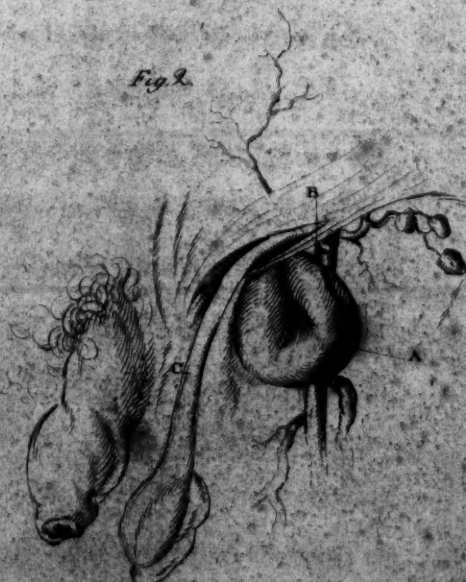
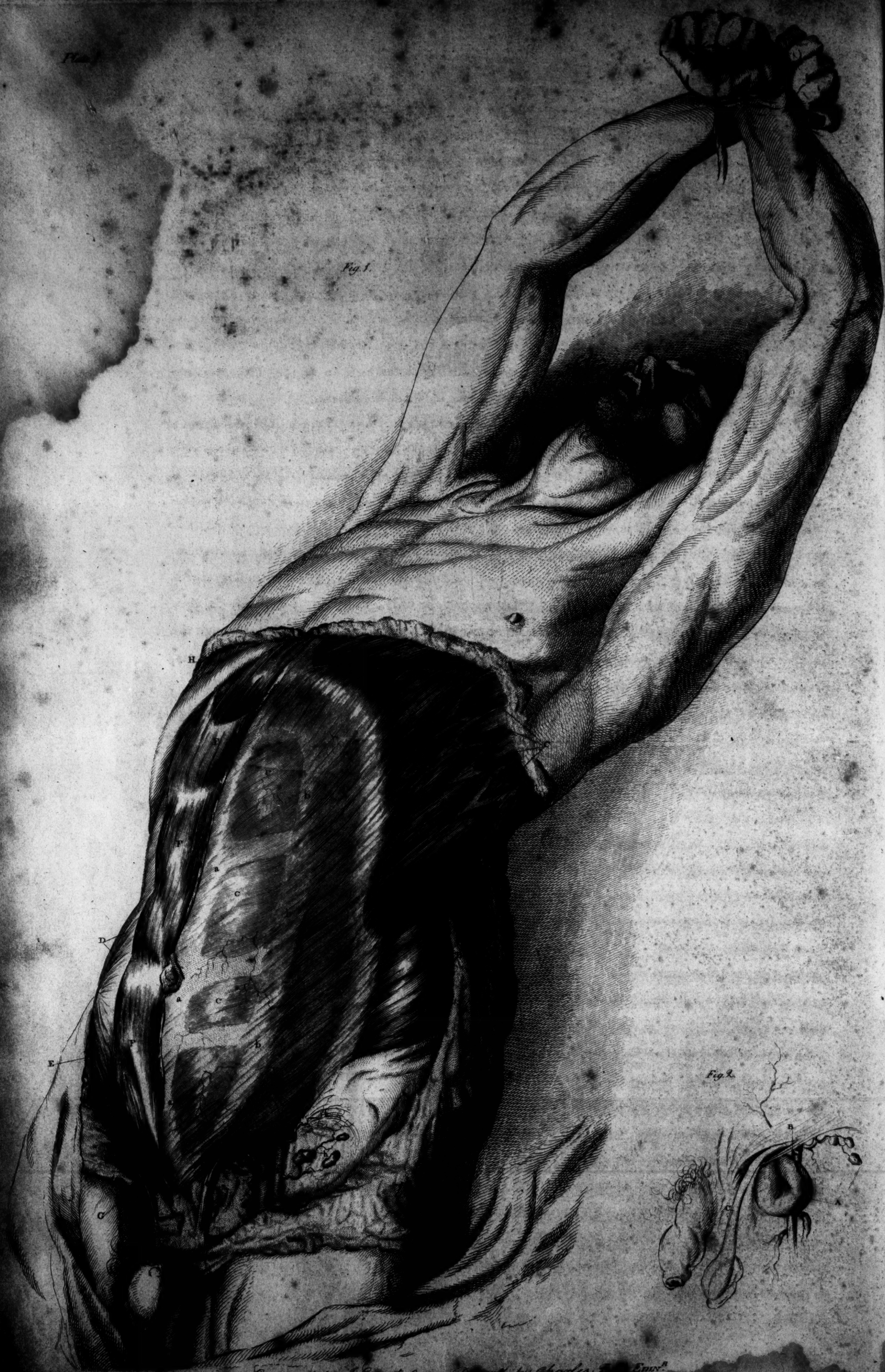
SECOND STAGE OF THE DISSECTION.

HAVING paid equal attention to the dissection of the muscles of both sides of the belly, you proceed thus: Dissect off the serrated origins of the external oblique muscle from the ribs, and from the space between the ilium and false ribs, and detach it from the *OBLIQUUS INTERNUS* (D E) which lies below it. You will recollect that the obliquus internus ascends from the ilium (n), spreading its fan-like fibres in a direction which forms an acute angle with the fibres of the external muscle which you are dissecting off. Continue to separate the external and internal oblique muscles, till you find them firmly attached by their tendons to the linea femilunaris. Betwixt them there is interposed some loose cellular substance, which mars the beauty of the lower muscle if not carefully dissected away—and you find them connected by the branches of the arteries and veins piercing them to gain the skin and cellular substance. Observe the origins of the *OBLIQUUS INTERNUS ABDOMINIS* from the spine of the ilium, and apparently also from the mass of muscular and tendinous origins of the muscles of the back (you will find it very difficult to dissect its origins from the spine, as described in books). Those fibres of the muscle which originate from the back part of the spine of the ilium, run directly upwards (D) to the cartilages of the false ribs. From the fore part of the ilium its fibres are continued more in a direction across the belly, and from its lowest portion (E) which runs directly downwards in the direction of the external oblique, you find it sending off, behind the external ring, a delicate fasciculus of fibres (r) which invest the spermatic vessels, and forms the origin of the *CREMASTER MUSCLE*.

The belly of the internal oblique muscle ends in a uniform edge, and its tendon is finally inserted into the linea femilunaris: but here it is to be remembered, that some anatomists have described its tendon as splitting into two layers, one forming, with the external oblique, the outer part of the sheath of the rectus; the other forming the inner part, with the tendon of the transversalis abdominis.

This inner oblique muscle, when dissected, should be left in its seat, and the outer muscle replaced over it. Then making an incision by the side of the linea alba, which opens the sheath of the rectus, you dissect it back towards the linea femilunaris. In doing this you must separate carefully the sheath from the tendinous bars of the rectus muscle, for at these parts they are firmly blended together. Towards the bottom of the sheath, you find the *PYRAMIDAL MUSCLE* (G) running up from a broad origin upon the os pubis, to an acute point inserted into the linea alba. The two pyramidal muscles rising together, one on each side of the middle abdominal line, form a cone that is sometimes observable, shining through the strong sheath which covers them. These parts being completely dissected, return them to their former place; and having continued the dissection of the muscles of the other side exactly in the same manner, proceed after this method:





Engraved by J. Grant from a Dissect. by Charles Bell Esq.

The tendon of the internal oblique muscle is to be cut from its connections with those of the other muscles at the linea femilunaris (b b): Then dissect the muscle back towards its origin upon the spine of the ilium; and laying it over the haunch, you have an opportunity of observing the course of the TRANSVERSALIS ABDOMINIS.—You find its fibres running across the belly, more in the direction of the external oblique, than in that of the last dissected muscle. You see it arising fleshy, from six of the lower ribs, upon their inside, (which has allowed some anatomists to describe minutely its digitations with the diaphragm); and tendinous, from the mass of muscles upon the loins. It runs a little round towards the side, where the strongest part of the muscle is formed. It arises likewise from the spine of the ilium, and even from the outer part of the ligament of the thigh. It is inserted into the linea alba, having previously connected itself with the linea femilunaris. It will be observed, that towards the lower part of the belly, this muscle appears deficient, and the bowels are seen through the peritoneum, the outer surface of which is covered with much confused cellular substance, and unlike its smooth inner surface, which is applied to the intestines.

These parts being thus dissected, can be demonstrated in such various views, and with such quick succession, lifting and replacing them, that they cannot fail to be effectually understood. And having carefully observed their strict anatomy, no one can be at a loss to recapitulate their general character and uses.

It may be observed in the skeleton how great a space there is to be covered from the edge of the thorax to the brim of the pelvis, and backwards to the spine; and recollecting, that in this space are contained the soft viscera of the abdomen, and that these must be sustained by an elastic and yielding covering, it will be understood how this covering, whilst it supports the viscera, and yields to and assists the operation of the diaphragm, must support and poise the whole trunk upon the pelvis; and that although the muscles of which it consists be thin and delicate, yet, having so great a lever as the edge of the thorax, while the centre of motion is at the spine, it bends the upper part of the body with great force.

EXPLANATION OF PLATE I.

OF THE ABDOMINAL MUSCLES.

Fig. 1. While, from the obliquity of the figure, we have a full view of the most important part of the demonstration, the external oblique muscle, the others, viz. the rectus and transversalis of the right side are necessarily seen fore-shortened by the convexity of the belly.

A, The origin of the EXTERNAL OBLIQUE muscle of the abdomen from the ribs, making serrated indentations with the serratus major anticus.

B, The stronger fibres of this muscle coming round upon the loins, where it is covered by the latissimus dorsi.

C, The SERRATUS MAJOR ANTICUS.

D E, The INTERNAL OBLIQUE MUSCLE of the abdomen,—its fibres spreading from the central origin upon the spine of the os ilium and sacrum, to its insertion into the false ribs, linea femilunaris and os pubis.

* The fibres of the CREMASTER MUSCLE as sent down by the internal oblique muscle.

F F, The fleshy portions of the RECTUS muscle.

G, The PYRAMIDALIS.—It is uncovered on one side, on the other included in the sheath.

H, The origin of the PECTORALIS MAJOR, which intermixes its fibres with the obliquus externus and rectus muscles.

OF THE TENDON OF THE OBLIQUE MUSCLE.

a a a, The LINEA ALBA.

b b b, The LINEA SEMILUNARIS.

- c c c, The RECTUS MUSCLE shining through the transparent tendon of the external oblique muscle.
 d, The tendon where it splits to form the ring.
 e, The SPERMATIC CORD.
 f, The FEMORAL ARTERY.
 g, The FEMORAL VEIN.
 h, INGUINAL GLANDS and cellular membrane.
 i, The EPIGASTRIC ARTERY.
 k, The CIRCUMFLEX ARTERY of the ilium.
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GREAT collections of matter form betwixt the peritoneum and abdominal muscles: They are more frequent in women; when they are the consequence of puerperal fever pus is not discharged, but there is an extraordinary and long continued discharge of serum, which is the peculiar mark of the inflammation of the peritoneum; it is like the discharge from a scrophulous knee joint. In consequence also of violent inflammation, as from lithotomy, the peritoneum pours out matter into the cellular substance which surrounds it.

It is wrong to cut across the belly in opening such collections of matter, unless the muscles have been destroyed by the matter; because the fibres of the muscles would in this way be cut across, when they retract, and form a gap; at the same time the possibility is increased of wounding the epigastric artery which runs up the belly. By opening these abscesses with an incision parallel to the fibres of the muscles, the parts are divided, without allowing the muscles to retract; and the chance of wounding the arteries is lessened. In tapping for the dropsy, it is said that the epigastric artery (the course of which I have marked in the Plate with a dotted line), is sometimes wounded, or its accompanying vein. But it should be expected, when these were wounded, that while the canula remained in the wound, distending the orifice, they should not bleed. If they should bleed, however, they may probably be stopped by pressing the canula obliquely to one side, or taking a ply of the muscles and integuments betwixt the fingers. I have never seen an accident of this kind; but such cases have been described to me, where the deluge of waters was coagulated in the tub. Perhaps an enlarged spleen, or some of the viscera touched with the trochar, may sometimes account for such a bleeding.

It has sometimes happened that the epigastric artery has been struck without the bleeding immediately tinging the water; and the accident has been marked only by the sinking of the patient, the feeble pulse, distention of the abdomen, and sudden death; upon dissection, great coagula have been found covering the viscera.

The umbilical rupture, or rather the deficiency of the abdominal muscles round the navel, is a very frequent mal-conformation in infants. I have twice seen the peritoneum distended to a size larger than the child's head, perfectly pellucid, and containing the liver, colon, and most of the small intestines; in neither of these cases was any peristaltic motion to be observed. The peritoneum soon inflames, becomes white, and totally loses its transparency; in a lesser degree, this is a very common occurrence. The umbilicus will sometimes open in such cases as I have mentioned, after child-birth, and remain long a fistulous fore. Pott had seen terrible mischief from the bursting of a cicatrix on the navel, during gestation; it was the fear of an abscess which had been opened by incision. Ventral hernia is commonly betwixt the recti muscles; it is the deficiency of the tendinous parts, rather than the splitting of the coarser muscular fibres, which allows of rupture.

N. B. See, for a description of the Ring in Hernia, Part III. containing the Anatomy and Diseases of the PELVIS.

DISSECTIONS

OF THE

VISCERA OF THE ABDOMEN.

FIRST DISSECTION:

Of the manner of Opening the Body, and observing the general Situation of the Viscera.

AS the great use of dissection is to acquire the knowledge of the parts in the living body, it is proper, before opening the belly, to read the general description of the parts;—to learn the boundaries of the abdomen; the situation of the diaphragm, encroaching upon the cavity of the thorax; the tract of the intestines; and the place of the more important viscera;—how the liver and stomach are received within the margin of the ribs, and guarded by them;—how the arch of the colon winds round under these; and how the small intestines are collected in a group under the navel. It is of importance to mark the situation of all these parts, and to conceive which should be wounded by pointed instruments, pushed in various directions. A wonderful degree of accuracy will thus be acquired in those points, which are of the greatest importance both to the Physician and Surgeon.

In opening the belly *, if the operator be not too finically inclined, a simple crucial incision is made; one cut from the scrobiculus cordis to the pubis, keeping the left side of the navel; and another crossing it from the spine of one ilium to that of the other, coming below the navel, that there may be an opportunity of seeing the remains of the umbilical vein continued into the liver. In doing this, the only care should be to avoid cutting the intestines, by raising the integuments from the viscera, after the first puncture. Having thus laid open the belly, it will be seen whether the preconceived ideas of the situation of these parts be correct.

The following are the points to be observed, and which will lead on, without confusion, to a full demonstration of the whole.

1. The GREAT ARCH OF THE COLON (Plate II. Fig. 1, and 2. a a a), mounts up from the os ilium of the right side, crosses the belly under the edge of the liver (o) and brim of the thorax, and descending again upon the left side, sinks under the small intestines, and rests (at b) upon the wing of the os ilium; thus surrounding the small intestines, which lie together in the middle of the belly.

2. The STOMACH will be found retired under the ribs, and covered by the arch of the colon: And,

3. The OMENTUM will be found (Plate II. Fig. 1. d d, and Plate IV. Fig. 3. c), proceeding from the stomach and colon, which lie contiguous, and stretching down over the small intestines, a delicate and expanded membrane, loaded with fat.

Such is the general appearance upon the first opening of the abdomen. But as one part of the intestinal canal may happen to be more inflated than another, this regularity will sometimes be disturbed. The stomach may be distended, and the colon flaccid and empty; consequently, instead of the colon be-

* I speak here as if a new subject were bestowed on this demonstration; but there is no necessity for it.

ing the prominent part, it may seem to have subsided, and be scarcely distinguishable from the small intestines, while the stomach may push out its white expanded sides from under the liver and the ribs of the left side: or perhaps the stomach and colon may have both receded, by the expansion of the smaller intestines. Now, in this state of the intestines, if an attempt be made to unravel them with the hands, there is every probability that they will be tumbled into greater confusion and disorder. It should be remembered, that in the examination of all these parts, the colon is the sure guide; for the caput coli (Plate II. Fig. 2. e), is fixed down by the peritoneum to the loins, upon the right side; and from this the colon can be always traced up under the stomach, and above the small intestines. This portion is called the Arch of the Colon (a a a); and if you puncture it, and introduce a small blow-pipe, and blow it up, then every thing seems to take its true place. As the colon swells up, it shows its ligamentous bands, and the cells so peculiar to it. It is seen rising before the stomach, descending upon the left side, and under the small intestines, and finally tied down by the peritoneum to the loins upon the left side, forming at this place the sigmoid flexure of the colon (Fig. 1. and 2. b), which is the last portion of this gut. From this point to the anus, the continuation of this intestine is the RECTUM (Fig. 2. f).

In this first display of the viscera, there is a very partial view of the intestines: Only a part of the colon, jejunum, and ilium is seen; and to trace the whole length of the alimentary canal, this natural order must be deranged.

COURSE OF THE INTESTINES.—Finding the great curvature of the stomach, and the arch of the colon connected by the omentum, separate them, by detaching the omentum from its connection with the colon, and lay the great intestine down over the small intestines. You then find the stomach lying obliquely across the upper part of the belly, towards the left side, a conical bag, bent upon itself (See Plate IV. Fig. 3.); so that the two ends approach, forming on the under side a greater curve (g g), and on the upper side a lesser curvature (f). The greater curvature presents itself in this view of the parts. The cardiac orifice, or entrance of the œsophagus (h), lies out of sight; and even the pylorus (L) recedes out of sight when the stomach is distended. Towards the left side, under the ribs, and hanging on the great curvature of the stomach, you find the SPLEEN (See Plate IV. Fig. 1. g.), of a dark and livid red colour. You see the DUODENUM, the first intestine (Plate II. Fig. 2. g, and Plate IV. F. 1. e) taking a turn upwards from the pylorus (Plate II. h, and Plate IV. Fig. 1. L), stretching a little to the right side, then turning upon itself, and descending under the mesocolon towards the right kidney. Observe how it is bound down at this point; observe also its situation with regard to the stomach and liver, and arch of the colon; and remember that it is here within this space that it receives the pancreatic and gall ducts (See Plate IV. Fig. 2.). Neither of these ducts can be seen in this stage of the dissection, the pancreas itself (as represented at p p), being obscured in the cellular substance at the root of the mesocolon—and you may feel it under the stomach, a hard conglomerated mass, stretching directly across the spine. The true extent of the duodenum is from the orifice of the stomach (Plate II. Fig. 2. h), to the place where the gut emerges from under the mesocolon (i). It lies before the emulgent vessels, before the aorta, and upon the last vertebra of the back. It is larger than any of the other small intestines, and sometimes is very greatly distended.

Turning back the colon and omentum, fixing them over the brim of the thorax, and pushing down the small intestines towards the pelvis, you find the duodenum coming out from under the colon, but still tied close to the spine by the peritoneum, or lining membrane of the abdomen. After a little space, the intestine extricating itself from the ligamentous folds of the peritoneum, is seen rising up, and coming forward, and is called the JEJUNUM (k).

You have now to unravel those of the small intestines, which lie below the arch of the colon, as they at first present themselves to you. The small intestines are the DUODENUM (which you have already examined), and the JEJUNUM and ILEON. These two last comprehend the whole length of the small intestines.

below the mesocolon, the lower end of the ilium terminating in the caput coli, or beginning of the great intestines.

The JEJUNUM (k) is so called from being found more empty than the ILEON (l); but this must not be trusted to. It is said also, that it is of a redder colour, and more vascular and more abounding in the valvular processes of its inner coat; but this distinction may be rejected with safety, as authorised by Haller. In prescribing the limits of these two intestines, anatomists are reduced to the necessity of supposing them to be divided into five parts; two of which they give to the jejunum, and three to the ileon; which, showing the necessity of an arbitrary division, is therefore useless. It is sufficient to observe, that these small intestines may be pretty regularly divided into two masses, especially when inflated; that the upper portion, and that more to the left, is the jejunum, while the lower is the ileon; and that the situation of this last exposes it to hernia, especially on the right side. Very generally the portion strangulated is about a foot distant from the caput coli. Where the ileon enters the caput coli, there is a soft pendulous projection of the inner coat, forming a valve at the termination of the ileon. When the caput coli is inflated and dried, this valve appears like two transverse membranes, standing obliquely across the intestine, the one projecting over the edge of the other; so that matter endeavouring to pass from the large intestines into the ileon, shuts the transverse slit.

The GREAT INTESTINES form the last division of the intestinal canal. Tracing the intestines according to the course of the food, the first turns, or the convolutions of the portion nearest to the pylorus, (as at k), are situated further down in the belly than the last turns of the intestines; and these you find even lying contiguous to the stomach, as the great arch of the colon (a a). They certainly differ in their functions and use from the others, and seem to be the receptacle of the food which has already run through the more active small intestines. They form few convolutions; but being very capacious, although short, they fill a great space in the belly. They are commonly divided into the COECUM, COLON, and RECTUM; but it is surely better to divide them into the colon and rectum, and to subdivide the colon, as consisting of parts having a variety of shapes, and very different in their situation, into these three portions: FIRST, The CAPUT COLI (e), where the colon is tied down to the loins of the right side, comprehending the valve of the ilium, the cœcum, or properly, the beginning of the colon, lying in the space under the right kidney, hid by the convolutions of the intestinum ilion (Plate II. Fig. 1. e). Observe upon the outer side of the cœcum a little appendage, like a twisted earth-worm, and thence called APPENDICULA VERMIFORMIS (m, and Plate III. m). SECONDLY, From the caput coli you trace the colon, mounting upwards over the face of the kidney, and connected with it by cellular substance (See Plate III.). A little further up, you find it tinged with the bile (showing that it has lain contiguous to the gall bladder), and then going across the upper part of the belly, forming the GREAT ARCH OF THE COLON (Plates II. and III. a a). In this part, and in its whole course, you will observe its peculiar shape, notched into cells by the ligaments of the colon; which, running in the length of the gut, slip thin fibres into the interstices of these cells, and seem to form them by constricting the gut. THIRDLY, The colon then descends upon the left side, and going backwards, under the stomach and spleen, into the left hypochondrium, and then descending over the kidney of this side, it is connected with it, and is again tied down, but less perfectly than on the right side, forming some remarkable turns from the general direction, of which this part is called the SIGMOID FLEXURE of the COLON, (Plates II. and III. b). The last division of the intestinal canal is the RECTUM (Plates II. and III. f). Drawing aside the intestines, which rest in the hollow of the pelvis, you find the great gut continued down from these convolutions directly (as its name implies) to the anus, turning over the sacrum, and inclining a little to the incurvation of that bone.

The LIVER.—Replacing the intestines, you have to observe the situation and general figure of the liver. You find the upper surface convex, answering to the concavity of the diaphragm. The under surface is irregularly concave, answering to the parts it has to receive; it is thick backwards, and on the

fore part laps over the stomach and colon with its thin extenuated edge. Its ligaments rather connect it with the neighbouring parts, than support it; and these connections are disposed so as not to interrupt its gentle motion in respiration, but tie it to the diaphragm, the moving part.

The PERITONEUM.—One great object to be studied in this the natural situation of the bowels, is the peritoneum—and the knowledge of this membrane must include the whole general anatomy of the abdomen. It has been invariably the custom of anatomists to pay much attention to the course of membranes, not only in the belly and breast, but in the more delicate organs, and to trace them in all their windings, deriving one inflection or process from another. But one may easily conceive how all the investing membranes or surfaces of the viscera and muscles, and of all the variety of parts contained in the belly, were formed at the same time. And here in the abdomen all the surfaces of the intestines, of the liver, of the parieties of the belly, or inner surface of the abdominal muscles, have one common nature. They are all smooth, polished, and continually exuding a serous fluid, which allows one part to glide easily upon another, and to lie in contact without adhering. And as the contents of the belly, though all within one common cavity, do not lie loose, but are attached, the whole surface must be continuous. Now every part of the body, as it differs in structure or use from that to which it is contiguous, is separated from it by a substance differing in its nature from both, viz. the CELLULAR TEXTURE. This substance is elastic—easily dilatable and contractile—dividing one vessel from another, and one muscle from another; without which there would be no action allowed in vessels, nor motion in muscles and their tendons; but the whole body would remain a solid and inactive mass. We find in the belly (as in the stomach and intestines, and in the bladder) one layer of membrane separated from another, where they differ in structure and economy—and so the outer layer or surface of all the contained parts in the belly has a common nature, which differs in its properties from the parts which it covers, whether the muscles of the abdomen or the intestines—and it is separated from them by interstitial cellular substance, and appears, upon careful dissection, a distinct membrane, viz. the peritoneum. If this is to be considered in the light of a separate membrane, involving all the bowels in its doublings, then its demonstration is to be followed in this manner: It is seen lining the abdominal muscles which have been laid back—it can be traced from the lower flap over the os pubis, reflected over the bladder, and again running down betwixt the bladder and rectum—then embracing the rectum, and connecting it to the spine, and while it gives easy access to its blood vessels, involving them in its duplicature. When you put down your hand behind the bladder, you find that you can proceed but a little way; your finger is impeded by the membrane being reflected from the bladder upwards over the rectum, thus separating the viscera of the abdomen from the pelvis. There is no cavity, as it is called, in the pelvis, but the parts are connected by loose cellular membrane, and it is the motion of the abdominal viscera which requires the general smooth and investing membrane. Above, upon the liver, is seen in the same manner the peritoneum continued from the muscles of the abdomen over the inside of the ribs, and under surface of the diaphragm; reflected from the diaphragm upon the liver; and forming the broad or middle ligament (LIGAMENTUM SUSPENSORIUM), which reaches down from the integuments of the abdomen, and is inserted into the upper surface of the liver, in a line with the great fissure which is on the lower surface, (See Plate IV. Fig. 1. c). You may observe in the edge of this a hard round ligament (b), better felt by the fingers than seen; it seems to proceed from the umbilicus, and is the remains of the great umbilical vein, which in the fœtus proceeded from the placenta. Drawing aside the colon and small intestines of the right side, to have a view of the right lobe of the liver lying deep in the hypochondrium, you may see the LATERAL LIGAMENT of this side thin and transparent, and formed like the others by the peritoneum reflected from the surface of the diaphragm. And when you look up under the diaphragm, holding down the liver, you see an extensive attachment betwixt them, which, including a circular portion of the liver, is called the CORONARY LIGAMENT of the liver.

It cannot be conceived that these ligaments support the weight of the liver—they are in themselves de-



Fig. 1.

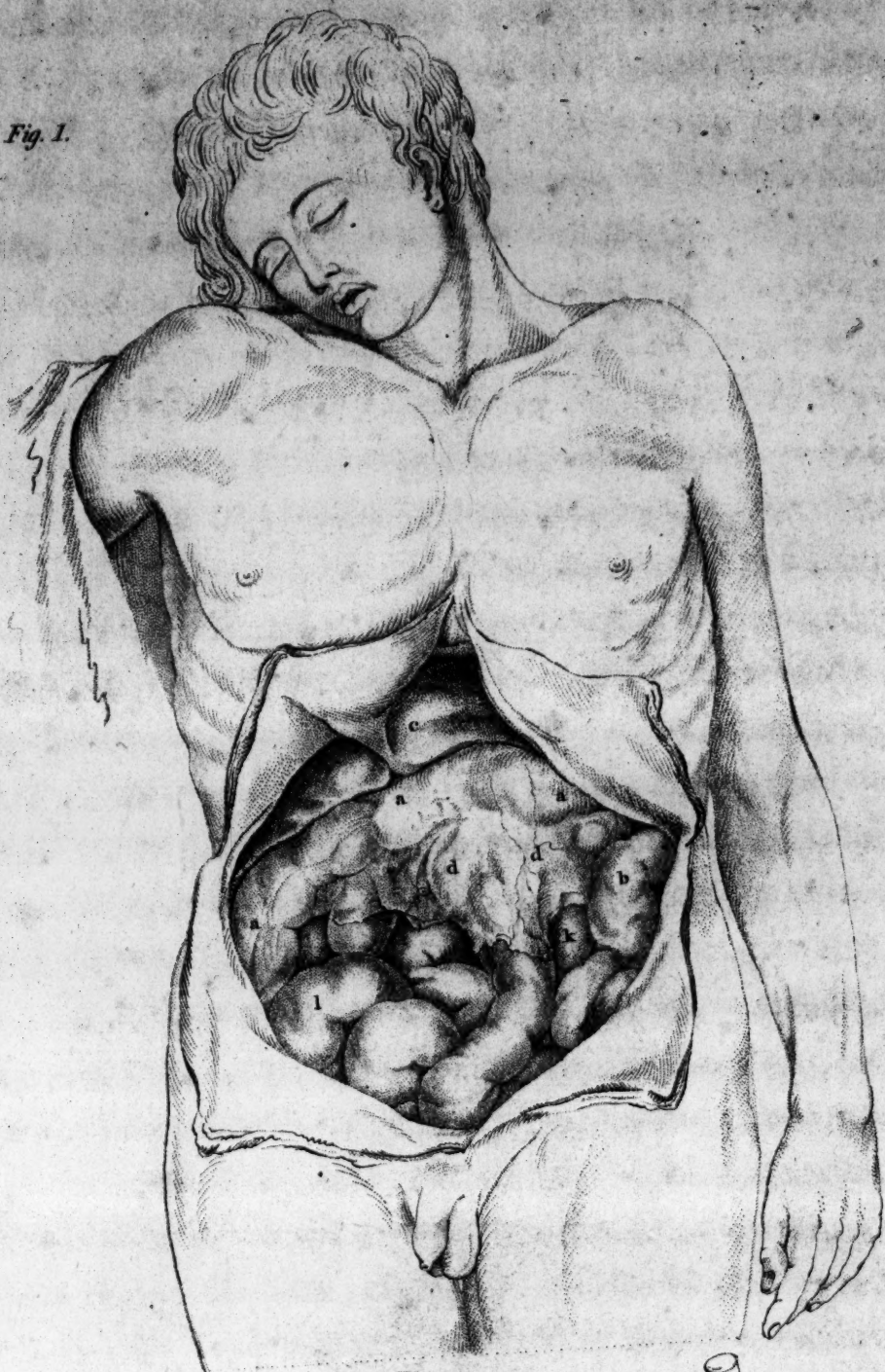
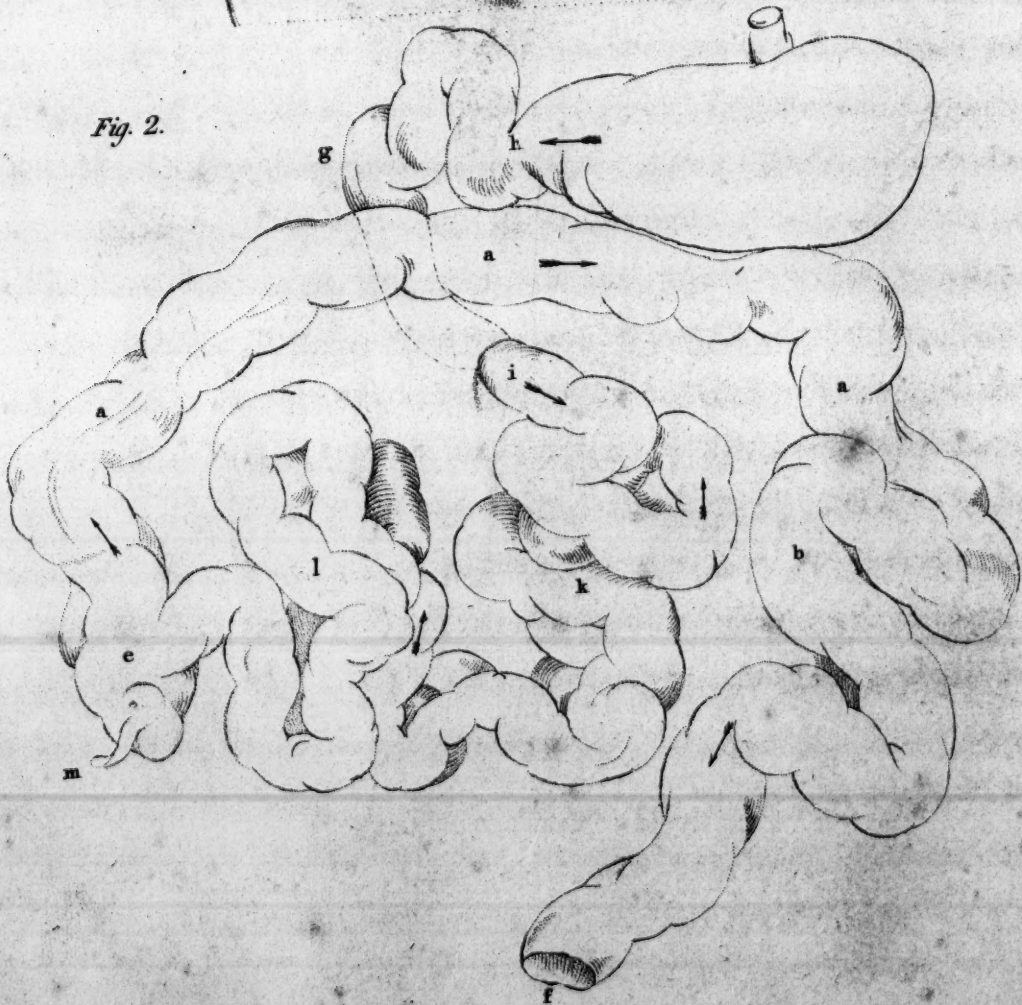


Fig. 2.



licate—and all the ligaments and processes in the belly, partaking of the nature of the peritoneum, are gradually elongated upon the slightest extension. But were they in every respect calculated to support the liver, their insertion into its soft substance would be unable to bear its weight; it is the equable pressure of the abdominal muscle that support it, and all the viscera of the belly. And it may be observed, that the great peculiarity both of the abdomen and thorax is, that the lungs in the one, and the intestines in the other, containing each a proportion of air, give a uniform and elastic resistance, while the vessels in the limbs and other parts of the body act under a more incumbent and sluggish weight.

The MESENTERY, MESOCOLON, and LIGAMENTS of the COLON, are formed thus: The lining membrane of the inside of the belly, when it comes to the spine, mounts over and covers all the parts that lie contiguous to the spine; investing them on the fore part, but leaving them at their attachment to the back, involved in cellular membrane. In this manner are situated the kidneys—the great vessels—the thoracic duct, &c. These may be considered as without the peritoneum. But indeed all the contents of the abdomen may be considered as equally without the peritoneum—for they lie as if they had forced themselves forward from the connection with the back, carrying the peritoneum before them. The intestines are in this situation; the peritoneum coming off from the back bone and loins, on either side of the vessels which go to supply the intestines, includes them in a double membrane—the mesentery, which, when it reaches the intestines, separates again, and, stretching over the gut, forms its outer or peritoneal coat. In the same manner is formed the mesocolon of the great intestine, answering to the mesentery of the small intestines.

Yet this method of explaining, although in a certain degree it may give a clear and precise idea of these parts, may be carried too far, and become intricate. The OMENTUM (Plate IV. Fig. 2. c. c, and Plate II. d d), that delicate, and in many instances pellucid membrane, loaded with much fat, which first presents itself on opening the body, is described by anatomists as consisting of four layers; for being a double membrane (which can be demonstrated by blowing it up), and each of the membranes being formed by the peritoneum coming off in a double layer, the one from the stomach, and the other from the arch of the colon, they thus reckon it, as consisting in all of four layers of membrane. From these connections, this the great omentum has received the name of GASTRO-COLIC OMENTUM. Its connections and double layers are best demonstrated by introducing a large blow pipe under the great vessels going to the liver, pointing it towards the left side, and blowing it up. It may be traced on the left side to the spleen (Plate IV. Fig. 2. g), which it connects with the obtuse end of the stomach running round to the œsophagus, and being continued even into the LESSER OMENTUM (i). This lesser omentum is found by folding down the stomach, and exposing the under surface of the liver. It is a membrane of the same nature with the last, running back from the lesser curve of the stomach, reaching from the cardiac to the pyloric orifice, and spreading backwards to the liver. It forms thus a web, concealing the little lobe of the liver and the pancreas. In injecting the stomach, this membrane ought to be carefully preserved, as it is supplied with arteries from the coronary arteries of the stomach. There is yet another division of the omentum—the OMENTUM COLICUM, which is continuous with the great omentum, arising from the right side of the colon, and ending conically above the cæcum.

EXPLANATION OF PLATE II.

IN Fig. 1. the view we have of the viscera when first laid open, is represented. As partial turns of the intestines only are seen here, the second figure is added, to show, in one view, the whole course of the

D

intestinal canal ; and as the letters mark the same points in both figures, the reader can easily find the situation of the parts in the body, and their place in the canal.

In both figures, a a a marks the arch of the colon—b, The sigmoid flexure of the colon—(In Fig. 1. c, The liver—d d, The omentum)—In Fig. 2. e, The caput coli—f, The rectum—g, The duodenum, before it sinks under the mesocolon to appear again at i—h, The pylorus—k, The jejunum—l, The ileon—m, The appendicula vermiformis.

EFFECTS OF DISEASE UPON THE ABDOMINAL VISCERA.

ON this subject it is of importance to study the nature of inflammation, of adhesions, and suppuration, and the almost uniform consequence of disease upon the peritoneum. It will be easy, when this knowledge is acquired, to unravel the diseased viscera, which, without it, must appear confused and intricate.

Active inflammation should be distinguished from turgidity of the vessels ; for often a fulness of the veins, mechanically produced, is described as an active inflammation in the brain and in the pleura, and still oftener in the abdomen. In dropsy, in violent distention of the intestines, in tympanites intestinalis, and after child-bearing the veins of the intestines and peritoneum are often found distended with blood. But in real inflammation, the peritoneum becomes thickened, pulpy, and less transparent—the blood is also of a brighter red colour.

As the eye becomes dry and painful and inflamed when the eyelids are forcibly kept open and prevented from spreading the secretion upon its surface ; so, when the enveloping membrane of the viscera is exposed, the natural secretion of its surface is destroyed, and it is irritated and inflamed. Or, by inflammation from any other cause, the secretion is destroyed ; the parts lying in contact are no longer kept separate ; they mutually affect each other ; and producing a new action, unite.

Adhesions is produced in the peritoneum and intestines in a wonderfully short time ; and the smooth membrane, when it is torn from its new connections, appears cellular ; or, upon being cut, thickened, and solid—or if the surface have undergone severe inflammation (without being allowed to form these adhesions which are so frequently the consequence of inflamed peritoneum), its surface becomes ragged, and numerous floculi of new membranes are formed upon it.

In diseases where inflammation has spread among the viscera, it is generally understood that the peritoneum is the original seat of the inflammation.—And according to this idea, it appears upon dissection, that the intestines do more readily than the muscles participate in the inflammation of the peritoneum. The muscles are indeed guarded in some measure by the loose cellular substance, which separates them from the peritoneum. But this does not satisfactorily account for what in the above view appears to be so great a difference between the sympathy of the intestines and that of the muscles with the peritoneum. The true explanation seems to be, that the disease or inflammation is in general communicated, not from the peritoneum to the intestines, but from the intestines to the peritoneum.—It is the disease of the intestines which produces those deadly symptoms that are said to mark inflammation of the abdominal cavity ; and although there are diseases in which the peritoneum is peculiarly the seat of inflammation, yet the inflammation of the peritoneum, produced by any external cause, is dangerous only by propagating its inflammation to the intestines.

In investigating the seat of disease in the abdomen, the dissection is very simple ; for there is seldom any necessity for minute inquiry. These are the stages : Make a crucial incision, at once laying open the viscera—or, if in a female, make your incision so as to leave a triangular flap to fall over the parts of generation, by continuing your longitudinal cut no further than the umbilicus, and from that point, mak-

ing an oblique incision on each side, towards the projecting point of the ilium, forming thus three triangular flaps. Then observe whether the parts are in their natural situation; examine the omentum, the stomach, the spleen, the intestines, and then the liver and gall ducts. Then separating the stomach and colon, connected by the omentum, raise the stomach, and examine the pancreas—Cutting up the adipose membrane, examine the kidneys, by making a section of them. Then following the ureters, examine the contents of the pelvis, &c. In making up your case, first mark the general deviations from the healthy appearance of the viscera; then detail the history of the disease, contrasting the symptoms with the state of the parts, and take notice of any anomalous appearances which seem unconnected with the principal disease.

This, in general, is the order of a dissection of these parts for the investigation of the cause of death; but it is proper, in the following remarks, to keep to the order of the demonstrations already given. I shall first, therefore, consider those viscera which lie in the upper parts of the belly, and are seen upon folding down the colon and small intestines.

Of the STOMACH, DUODENUM, and LIVER.—In examining the body, it will be observed how the stomach and spleen may be wounded by a thrust apparently into the thorax; or how the lungs and stomach, or lungs and liver, may be thrust through at once. It may also be observed how the stomach and liver lie before the diaphragm, where it goes obliquely down upon the back part of the abdomen; and how they lie contiguous to one another. The effect of hydrothorax, in pushing down the diaphragm, and depressing these parts—and the effect also of enlargement of the liver, or distention of the stomach, upon the breathing, must be obvious. It will also be seen how a hernia of the stomach into the thorax may happen by a rupture of the diaphragm.

The stomach is commonly retired behind the colon, and under the ribs. Yet, when slightly distended, it comes further down in the belly, and assumes the place of the arch of the colon. Therefore finding a patient with an open ulcer immediately under the scrobiculus cordis, discharging the contents of the intestines (an instance of which I have lately seen), it may be questioned whether it be an opening from the stomach or from the colon. This may perhaps be determined by observing the matter discharged, whether it be food partly digested, as from the stomach; or fæces, as from the colon, after having gone through the whole length of the canal.

Ulceration of the inner coats and cancerous tumours of the stomach are frequent. Upon the inside of the stomach, intestines and bladder, when violently inflamed by any irritation, there is often a general redness with bloody slime, or there are small blots of florid extravasation, as after poison. The few cases of cancerous tumours of the stomach which I have seen, accord with the common observation, that the upper orifice of the stomach is more liable to disease (owing to its more glandular structure), and more exposed to injury from substances swallowed. I have seen the whole upper half of the stomach, with its walls so much diseased, that they were not less than one inch in thickness, with their inner surface soft and cancerous. This disease was attended, during the patient's life, with a continual gnawing pain, with forebodings even upon taking the softest food, and with extreme pain upon swallowing any thing, in the slightest degree stimulating. In diseases of this kind, and where there are tumours projecting into the stomach, there is frequent vomiting of black chocolate-coloured blood, which is often attended with fainting. What marks the delicacy and weakness of the vessels of the villous coat, is the frequency of the discharge of blood from the stomach, as in vicarious hæmorrhage in obstructed menstruation, &c. In active inflammation of the stomach, the seat of it appears to be in the nervous coat; this is, because the net work of vessels there, are turgid, and have thrown out extravasation; but, we should not conceive, that this coat is alone affected.

Contractions of the œsophagus, and upper orifice of the stomach, are frequent; they are often spasmodic; but sometimes extensive ulcerations, or scirrhous thickening like those so common in the rectum, are found

upon dissection. When there is disease of the œsophagus, the stomach is found contracted in breadth, and scarcely to be distinguished from the intestines (HALLER); but it is said, that when the disease is lower down, the stomach is found to be distended. I do not know whether this last observation holds good. The stomach, however, is often distended so as to fill almost the whole belly, without any other extraordinary appearance. And in these cases the small intestines being compressed, occasions obstinate costiveness.

That the coats of the stomach are affected by its own juices, is now universally believed. But, as far as I have observed, erosion is not in such cases to be expected. Nor are the coats thinner; but they are thickened, gelatinous, yielding, and tender to the fingers; a circumstance that has often been troublesome to me in injecting the vessels of the stomach. That this is produced by the secreted fluid of the stomach, unassimilated with the food, we are assured from the intestines not being thus affected, though in the same circumstances with regard to putrefaction. Although it be a common and well founded observation, that the stomach is extremely delicate, and although the instances of sudden death occasioned by blows upon it are very frequent, yet there are some cases that would seem to form exceptions to this, showing us what disorders it will suffer, yet life be prolonged. A young man received a kick in the belly from a horse. It occasioned long a constant pain in the fore part of the belly, weakness and indigestion; these were succeeded by a tedious hectic fever, and at last proved fatal. Upon dissection, the omentum was found folded up and contracted round the stomach, forming a solid mass of about an inch and a half in thickness, and connecting the stomach and intestines and liver by its adhesions. The stomach itself was turned to a bloody grumous cancer. The outlines of this case will point out the difficulties which will sometimes occur in unravelling these parts when diseased.

Observe the situation of the liver towards the right side; how far it comes down into the right hypochondrium; and how dangerous and improper it consequently is to tap on this side, the more especially as the liver is often enlarged in dropfy. Observe, again, the close connection of the liver with the diaphragm, and how abscesses, originally formed in the liver, may, by the spreading of the inflammation, and by the adhesions with the diaphragm, communicate the suppuration to the lungs, so that the matter from the liver may be coughed up from the breast; or how hydatids originally formed in the liver may, by the same communication, be coughed up from the lungs; or how matter in the liver may, by its natural tendency to the surface, propagate the inflammation to the abdominal muscles, and, by forming adhesions with them, be discharged outwardly. In this last case the adhesions, always preceding the formation and progress of matter outwardly, the attachment of the liver and integuments is close and intimate, and the abscess points regularly, so that the operation is very easy. Abscess of the liver, besides being attended with a peculiar painful feeling in the right hypochondrium, is accompanied with a sharp pain of the shoulder of the same side; yet it sometimes happens, that the liver is like the kidney, so little sensible, that, upon dissection, there are found great abscesses where the patient, during life, had no complaint. There are, in the writers upon the diseases of hot climates, some strange examples of the extensive communications of these abscesses.

After having observed the intimate connection of the liver, duodenum and stomach, it is easy to conceive a case which not unfrequently happens, viz. a discharge of matter into the stomach and intestines, and even a discharge of the food by the external wound, after an operation for abscess of the liver; for it has happened, that the abscess of the liver has formed connections with the stomach on the one hand, and, on the other, opened outwardly upon the side of the belly. It will also be seen how hydatids, getting entangled with the intestines, may be discharged by stool; and how tumours of the liver, pancreas and spleen, must oppress the stomach.

With regard to the operation for the collections of matter in the liver, unfortunate mistakes have been made. There is a case mentioned by Haller, of what he calls a spurious aneurism, in which, upon the tenth rib below the scapula, and in the muscular flesh of the back, there seemed to be the pointing of

an abscess, which yielded to the fingers; the patient having at the same time a flow fever, and a jaundiced complexion. They had no doubt of its being an abscess of the liver; but the patient died of the violent hæmorrhagy the night following the operation. There is another case which brings home to us still more forcibly the importance of an accurate knowledge of these parts, and of a lively conception of the effects of disease upon them. In l'Hopital de la Charité in Paris, the operation for empyema was performed, but no matter flowed from the incision. They had been deceived chiefly by the circumstance of matter being spit up from the lungs. Upon dissection, they found that the matter had been originally formed in the liver, and from it had been communicated to the lungs; but that this communication, having been formed deep in these viscera, no matter could flow from the incision. In Ruysch there is another case of a country surgeon cutting into the liver, when operating for paracentesis of the thorax; and the case shows, at the same time, the possibility of mistaking enlargement of the liver with hydatids for hydrothorax. See in SANDIFORT (*Obser. Anat. Path. Lib. III. Cap. V. p. 83. Not. e.*); a curious case of abscess; and indeed instances of such cases are very numerous. It has been found, too, that such is the sympathy between the stomach and liver, that the dressings after the operation for abscess being too much stuffed into the wound, have occasioned violent bilious vomiting, which was removed upon withdrawing them.

In dissection, there is frequent occasion to remark the softness of the liver when diseased; and it is necessary to observe its colour when not diseased, so as to be able to judge in any other instance how far its colour is natural. Often, in disease, it is of a lighter colour, or spotted and marbled, or its thin edges are found tinged with blood as if inflamed, or perhaps they are found livid, which may sometimes be produced by the position of the body after death, and the gravitation of the blood, as happens in the lungs. At any rate, there is seldom active inflammation of the liver. It is often schirrous and enlarged, and then ascites is frequently combined. Its schirrous state, when far advanced, is palpable enough; it feels knobby and irregular on the surface, and, when cut, the tubercles are generally of a light brown colour. See varieties of these in Baillie's Morbid Anatomy. Often I have met with scrophulous enlargement of the liver with the tabes mesenterica in children, the liver enlarged, of a pale, red, or yellowish cast, with spots of florid blood; the glands of the mesentery enlarged, hard, white and cheesy. The liver, the kidney, the spleen, and the uterus, that is, all the solid viscera, seem peculiarly the seat of hydatids, but particularly the liver; and from the bursting of the parent sacs, situated in these parts, the smaller vesicles get entangled with the membranous viscera.

The last circumstance that seems worthy of notice in this part of the belly, is the obliquity of the diaphragm, and the manner in which the parts lie upon it. If there be a tumour formed in any of those parts that are protruded by the action of the diaphragm, suppose an aneurism of any of the vessels, however the surface of the belly may be moved, the pulsation of this tumour will be continual upon the hand; but if the tumour be situated upon any of the vessels whose attachment to the spine hinders them from being displaced by the motion of the diaphragm, then the action of the diaphragm, and consequent protrusion of the viscera and integuments of the belly, will give the feeling as if its pulsation were subsiding, while the tumour retires from the hand. This circumstance, simple as it is, is the more apt to be overlooked, as a patient, when a physician feels his belly, does not breathe regularly, but strains and breathes at intervals.

OF THE COLON AND SMALL INTESTINES AS ALTERED BY DISEASE.—Where the arch of the colon crosses the belly, it lies contiguous to the stomach; and here, too, communications are sometimes formed by disease. As already hinted, there is some difficulty in examining such cases; for there is much confusion often, and massing together of the parts by inflammation. A case from Haller will illustrate this: He found in a woman the peritoneum, stomach, duodenum, colon, gall-bladder and liver, all grown together into

one confused mass, shooting fibres out on all sides, and degenerating on the surface into a thick soft matter, by which all these parts seemed to be glued together. There was also an ulcer forming a passage from the stomach into the colon, which was empty; and the stomach was disfigured all round the ulcer, by irregular schirrous tumours and abscesses. This horrible disease had gradually come on after a tedious child-bearing.

From the shape of the great intestines, and from their size and greater inactivity, it may be conceived how peculiarly liable they are to congestions, and the formation of balls and concretions. These accidents are peculiarly incident to the caput coli upon the right loin, and the sigmoid flexure of the colon on the left; and we find, in collections of cases, more frequent instances of congestions in these parts than in any other part of the canal. These concretions are sometimes formed into balls of amazing size, and the intestine, contracting round, embraces them closely. They are attended with great suffering, and continued colic pains, and partial inflations of the intestines, with tenesmus and gradual exhaustion of the body. It has happened, that such balls of immense size have been disengaged from their original seat, and have appeared at the anus, and been extracted, like the child's head with forceps. They are generally formed upon some nucleus of indigestible matter that has been swallowed, *e. g.* stones of fruit, bones, &c.

Injuries done to the great intestines, either by such congestions, or by ulcers and fistulous openings, caused by any hard substance swallowed, or the nestling of worms (cases of which are very numerous), are not so dangerous as in the small intestines, though both are equally liable, in their consequences, to produce peritoneal inflammation. According to the importance of the function which any part has to perform, the derangement of its action is dangerous to the constitution, and painful and distressing; while, on the other hand, there is no better proof of the danger and bad consequences likely to be produced by the inflammation of a part, than the pain and general effect which it has upon the economy. In the great intestines, the pain is sharp and rousing; in the stomach, and small intestines more heavy, and more oppressive and sickening.

The racking pain in inflammation of the belly, is not an ideopathic symptom of inflammation of the peritoneum, but of the action and tormina of the bowels, when excited in such a state of the parts as the diarrhoea of child-bed women, and the vomiting in incarcerated hernia; it is owing to the spasmodic contractions of the intestines. While in the most fatal kind of inflammation, as after lithotomy, or wounds of the viscera, there is no excruciating pain, but tenseness of the belly, faintness and languor.

In dissecting herniæ, where the inflammation of the abdominal viscera has been violent and suddenly produced, I have repeatedly found the SMALL INTESTINES connected more or less with one another, not only in the groin, where the strangulated gut adhered, but through the whole extent of the abdomen. But the peritoneum, which lines the abdominal muscles, I never saw connected with the intestines in this disease, unless at the part where the gut was confined in the rupture. This inflammation and adhesions of the intestines extending through the whole belly, while the general investing peritoneal membrane adheres only at the ring of the hernia, shows at the same time, that inflammation is propagated, not by the peculiar nature of the peritoneum, but by the sympathy among the intestines themselves. Daily experience shows us, the sympathy betwixt all parts of the alimentary canal—irritation will affect it universally, an acrid clyster will cause sickness in the stomach.

Adhesions thus formed may sometimes be obliterated again, if the violence of the first stage do not prove fatal. In the dissection of a man who died after the operation for hernia, and where the inflammation had been very extensive, all the small intestines were found glued together in one or two separate masses; and those, when cut out, and a section made of them, looked like a large honeycomb. Very much the same appearance occurred in another case, where the violence used to reduce the hernia, without incision, was so great as to occasion mortification of the gut after it had been reduced. In other

cases, where the inflammation had likewise been very great, the patient suffering long, and at last dying, after the inflammation had subsided, I have found (which indeed is often met with), bridles connecting the small intestines, like the chordæ tendinæ of the heart, an inch and a half in length, slender and crossing over an intermediate convolution of the intestine, and holding it thus as if in a noose, in imminent danger, one should suppose, of strangulation. Now, these strings must once have been adhesions formed by inflammation, and were probably broad and extensive at first, though now stretched out to this shape by the natural contraction of the intestines. Perhaps, if the patient had outlived the disease, and the intestines had regained their strength, such attachments might have been quite done away.

There is another circumstance to be attended to in explaining those broad adhesions betwixt the intestines. The accurate descriptions given of the shape of the intestines and stomach apply to them only when out of the body, or when the integuments are laid open, and the pressure of the abdominal muscles taken away. In the living body, the viscera must all be in contact with a broad and square surface; for, being contained within the abdomen, there are no interfices among them, nor between them and the general covering of the belly; and consequently they do not form (as they appear to do when dissected) complete circles, but are flat towards the integuments, and flat too on their sides, where they lie in contact with the next piece of gut.

Sometimes among the intestines (as in hernia), inflammation or suffusion of blood may be mistaken for mortification; but a dark lividity and tenderness of the intestines is the only unequivocal test of mortification. The effect of violent inflammation upon the surfaces, in making them become rough, or forming new membranes or irregular flocculi, was formerly taken notice of. One case of a most extraordinary nature I have seen: It seemed to be the consequence of inflammation of the peritoneal coat of the intestines, though probably it was a peculiar disease of the intestines;—a very vascular membrane, or entirely a new and numerous set of vessels, was formed upon the surface of the intestines, which was likewise studded with little opaque white eminences, like pustules, but hard and cheesy. I have these intestines minutely injected, and the vessels are most beautiful, running in radii, and in great profusion, to those little eminences.

Cases of TYMPANITES ABDOMINALIS often admit of dispute. Without denying the fact of air puffing up the belly, and being contained without the intestines, or in what is called the cavity of the abdomen, it may be observed, that this can happen only immediately before death—perhaps from gangrene of the intestines, and the consequent escaping of air from them. But the accumulation of air found in the abdomen on dissection is oftener generated by putrefaction after death; as in cases of gangrene of the intestines from hernia, in mortification after wounds, in gangrene of the uterus; and even where there have been no such immediate sources of putrefaction, there is often, upon opening the belly, a very disagreeable gust of air. To this source may perhaps be referred many of the tympanitic cases given by the older writers. Morgagni himself, upon many occasions, is too apt to overlook the origin of this air, generated by putrefaction in the body, counting it as natural and existing in the living body, and as escaping from the blood, where it counteracts the pressure of the atmosphere. For instance, he enumerates, in the history of a dissection, these appearances: The stomach and intestines were distended with air; the gastro-epiploic vein turgid with blood, which flowed out frothy when cut into;—there was a hernia with beginning gangrene and bloody serum in the cavity of the abdomen; the heart was large and flaccid, with black frothy blood in it; not a vein through the whole body but was distended with air and blood; the scrotum was puffed up with air, and was observed increasing even during the dissection, and the stench was so intolerable, that they were obliged to put a stop to the dissection. Now, Morgagni's intention in giving this case is not to put his reader on his guard in cases where the subject is so putrid, nor to caution him against describing such accumulations of air to any other cause but putrefaction; but it is to illustrate

an opinion he entertained, that apoplexy was produced by air extricating itself from the blood, and stopping the circulation in the small arteries of the brain.

The *TYMPANITES INTESTINALIS*, again, may be said to be a common occurrence, the intestines being often amazingly distended. I have seen two turns of the colon filling the whole abdomen, and compressing the small intestines, which were thickened, red, and fleshy; the distended intestine white, and free from inflammation, without any obstruction or apparent cause, but probably some loss of tone in the intestine*. In Haller's book of *Pathological Cases*, there is described a tympany of a peculiar kind (and similar cases are given by Morgagni, and in other collections); between the muscular and external coat of the intestines the air had raised vesicles, which, when opened, stunk intolerably; and Haller supposes this air to have been forced through the coat of the intestines, and only restrained by the peritoneal coat from forming a true tympanites abdominalis; but no membrane in the living body will allow air, or any fluid, to pass through it; and the coats of the intestines must have been totally destroyed before they could have allowed air to escape through them. It will be observed, that it is only by the contraction of their own coats that air or feces can be expelled from them into the cavity of the abdomen, and not by the elasticity of the air contained in them; because, when distended by the air, the intestines being in contact with the general covering of the belly, are supported by it, and were they like cobwebs they would never burst. I suspect that the air in the vesicles, in this case of Haller's also, was air generated by putrefaction; or like those vesicles which are formed in animals.

Upon this subject, although of great importance, I have not allowed myself to be very minute, and have mentioned only a few cases as illustrating the general principles of this part of Morbid Anatomy. Such morbid appearances only as may induce the student to reflect that he is not to learn the simple anatomy; but to study the natural structure, that he may comprehend the diseases.

SECOND DISSECTION OF THE ABDOMINAL VISCERA.

AFTER having carefully examined the natural situation of the viscera, and considered those varieties in their appearance which are likely to disconcert the dissector in investigating morbid anatomy, the intestines are to be removed in that order which may illustrate and confirm the ideas already obtained.

But when the object is a knowledge of the blood vessels of the viscera, the injection must be made before the intestines are roughly handled, or the delicate membranes of the omentum torn. The system of vessels to be injected before it is possible to study the vessels of the belly, is very extensive. It includes the aortic system, or arteries of the viscera; the venous trunk of the body; the veins of the floating viscera and the vena portæ; besides the venæ hepaticæ, biliary ducts, &c.

* When there is obstruction in the intestinal canal, the intestines above the obstruction, and in which the food has been accumulated, have their coats red and fleshy; but in the lower portion which has remained inactive they are white, and free from blood. So it happens in cases of fistula discharging the contents of the canal—for the feces, no longer passing downwards, the lower portion of the canal contracts, and seems to lose its natural functions. This is the danger of delay in such cases; for, upon the attempt to prevent the discharge and heal the ulcer, the intestines being unaccustomed to the stimulus of the aliment, colics, and by sympathy vomiting are the consequence.

INJECTION OF THE VESSELS OF THE ABDOMEN.

INJECTION OF THE ARTERIES.—As the nearer the tube is to the parts to be minutely injected, the greater is the chance of a successful injection; the tube should, in the present instance, be inserted into the aorta immediately above the diaphragm: or the aorta being tied at this point, the injection should be made from the femoral or iliac arteries. If the injection be made from above, the thorax must be opened; in doing which, the margin of the ribs to which the diaphragm is attached should be left entire. This saves the trouble of tying the phrenic arteries, which would be cut in separating the diaphragm from the ribs. It will also be necessary upon the left side to cut the ribs nearer to the spine, that access may be had to the aorta, which lies deep in the chest, upon the left side of the spine, flat and empty, and covered by the pleura. All the vessels cut upon the edge of the abdominal integuments must also be tied, care being taken to include all the principal branches, as the epigastric artery. And if, at the same time, the thigh is not to be injected, the external iliac artery must be tied, and a cord drawn round the thigh. To inject the thigh minutely from the aorta in the thorax, requires a force that may very probably burst the unsupported vessels of the intestines or stomach*. The intestines should be kept under warm water, or heated with sponges. The stomach also and bladder should be filled with warm water; and it should be remembered, that if the stomach be once distended too far, it will never be made to assume any thing of a natural appearance again. The celiac arteries are those in which rupture is to be expected.

By this injection, all the arteries of the stomach and intestines, with the hepatic arteries, and those of the pelvis and bladder will be filled, while, at the same time, the membranes will be minutely injected.

INJECTION OF THE VEINS.—The veins also must be injected before the intestines are unnecessarily handled. There are no valves in the veins of the intestines. The liver may be injected from the ramifications of the veins in the mesentery; or the minute extremities in the intestines may be injected from the trunk of the porta. To find the porta as it enters the liver, the stomach should be held down, and the smaller omentum cleared away from betwixt the stomach and liver. The vein is then found covered in part with cellular substance, running obliquely across the spine, and parallel to the biliary duct. If uncertain of its situation, the substance of the liver may be pressed gently with the hand, or the blood urged along the veins of the intestines, when the vena portæ will rise from the confusion a large dark blue vein.

If the veins of the intestines are to be injected, the tube may be inserted into the trunk of the vena portæ near the liver, and pointed downwards. But to inject the whole system of the vena portæ at once, a tube should be introduced into the ilio-colic vein. This branch is easily found, as it has its name from being subservient to the caput coli, and that part of the intestinum ilium which joins the colon, or the angle formed by the joining of the ilium and colon. It is only necessary, therefore, to fold back the small intestines from the right os ilium, and to expose the caput coli, and follow up the veins till they have assumed a size large enough to admit the tube. After puncturing and introducing the tube, there should also be a ligature upon the vessel behind the tube, to prevent the injection from coming round and escaping. Before throwing in the injection, these veins should be repeatedly syringed with warm water, especially those of the liver. In throwing in the minute injection, it may be made to run more minutely into the intestines (where alone it is needed) by pressing gently upon the trunk of the vena portæ. The vena cava abdominalis, and the veins coming into it from the liver, may easily be injected by tying the cava above the diaphragm, close to the right auricle, and injecting from the femoral or iliac veins.

* By injecting from the thorax, much is sacrificed to the arteries of the viscera. When the thorax is not to be opened, the injection may be made from the femoral arteries, while the aorta is tied above the celiac; but the injection always runs better from trunk to branch than in this retrograde course.

DISSECTION.

THE small intestines are now to be taken away, by folding the colon again over the breast, and searching for the beginning of the jejunum, where the small intestines come out from under the mesocolon, and where it is connected to the spine; then the intestine being tied here with a double ligature*, it should be cut betwixt the ligatures, and the gut should be separated from the mesentery, from this point downwards, following the convolutions of the small intestines, and leaving only a small portion of the ilium attached to the caput coli.

The intestines will now take a very simple form; only the colon and rectum, and the stomach, lying behind the colon, will be seen, and the duodenum coming from below it; and the course of the jejunum and ilium may be followed from the projecting portion of the duodenum along the edge of the mesentery, till the small intestines end in the caput coli. Again, the circle of the colon is to be followed round from right to left, till, after forming the sigmoid flexure, it terminates in the rectum. The dissection of the blood vessels may be conducted in this manner.

DISSECTION OF THE MESENTERIC ARTERIES.—The order of dissection is unfortunately not that which may seem the most natural, counting from trunk to branch; for the arteries of the small intestines must be displayed before there can be easy access to those of the stomach and liver. The colon should be blown up, and kept forming a full arch; then the vessels of the colon and of the rectum are to be dissected, and those of the mesentery, which lie in the middle. These comprehend the distribution of the upper and lower mesenteric arteries.

THE SUPERIOR MESENTERIC ARTERY (Plate III. A) supplies the small intestines, which have been cut away; and the right side of the great gut, which remains. Its trunk is found coming out from under the mesocolon (B B), and stretching over the duodenum.

THE INFERIOR MESENTERIC ARTERY (C) is much smaller in its trunk, and less extensive in its distribution. It supplies the left side of the colon and the rectum; running down over the os sacrum into the pelvis, from which the whole artery has got the name of hæmorrhoidal.

The dissection is to be begun with the loose mesentery, by dissecting off the peritoneal coat and fat from the vessels. These arteries of the small intestines (D) have no appropriated names, but compose one mass of innumerable branches, forming, before they reach the small intestines, frequent anastomoses and arches, by which the capacity of the branches combined must be wonderfully increased in proportion to that of the single trunk from which they arise.

From the UPPER MESENTERIC ARTERY, upon the right side, three branches are given off to the colon.

THE ARTERIA ILIO-COLICA (E), whose ramifications connect the branches which go to the small intestines, and those which go to the colon. It runs down in a direction to the caput coli (e), and last turns of the ilium (c). Its branches upon the small intestines inosculate with those branches of the superior mesenteric, distributed to the small intestines in general; and, upon the great intestine, it inosculates with the second colic branch of the superior mesenteric artery; viz.

THE COLICA DEXTRA (F), which will be found running from the root of the superior mesenteric artery across towards the right side of the colon, where it begins to rise over the kidney†, inosculating largely with the last branch downwards, and upwards with

* An intestine to be cut, must, for cleanliness, be tied with a double ligature, so that when cut the two ends may be close. In the same manner, when examining the diseased inner coats of the intestines, or their contents, portions in different parts of the canal should be taken out in this way, and slit up in a flat bason; and being cleaned, the diseased state is better displayed when they are floated in water.

† Let it be remembered, that the description always refers to the dissected body; and that the letters pointing out the parts upon the plates, are thrown in here only as assisting the description.



Fig. 1.

Plate 34

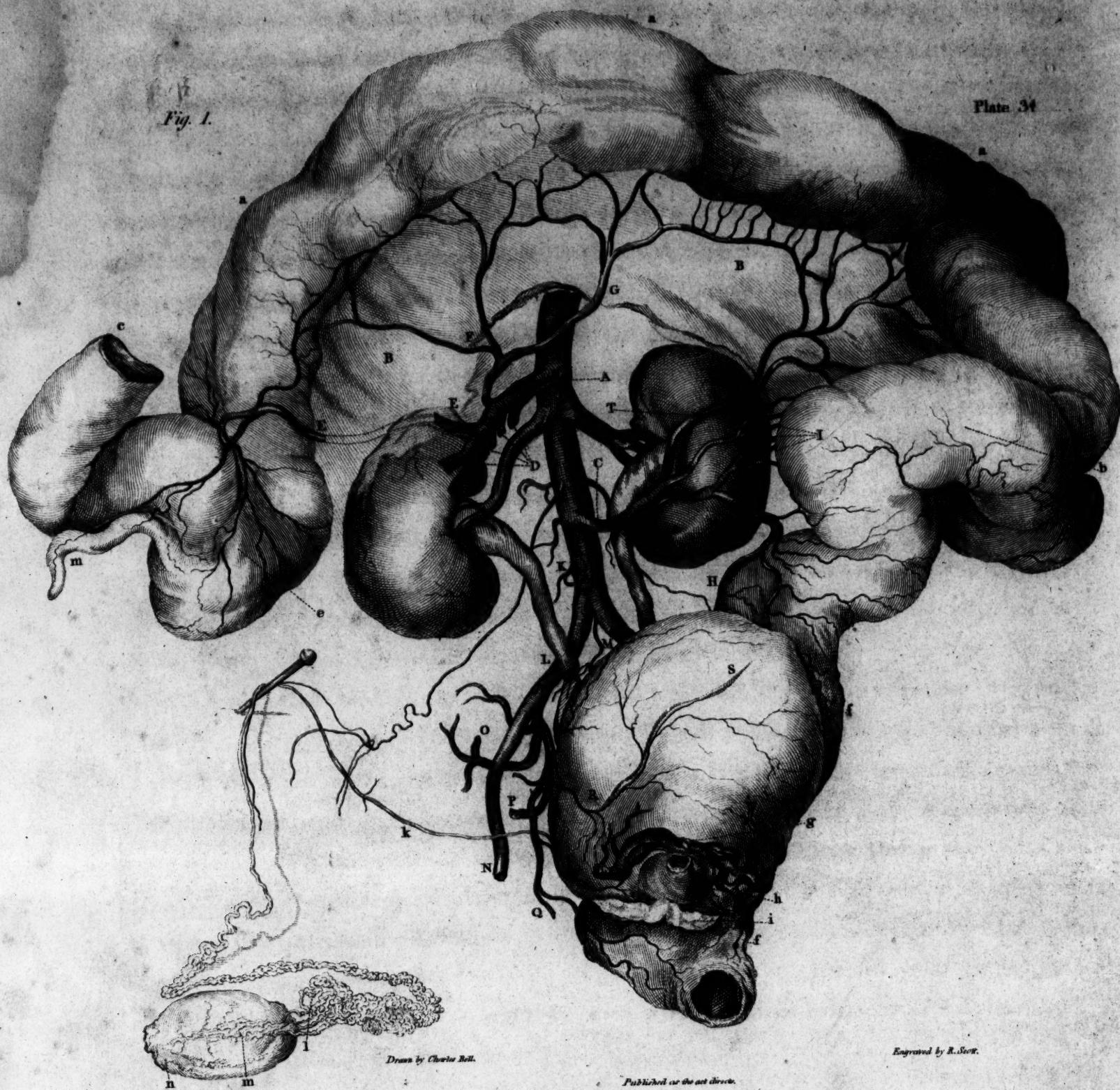
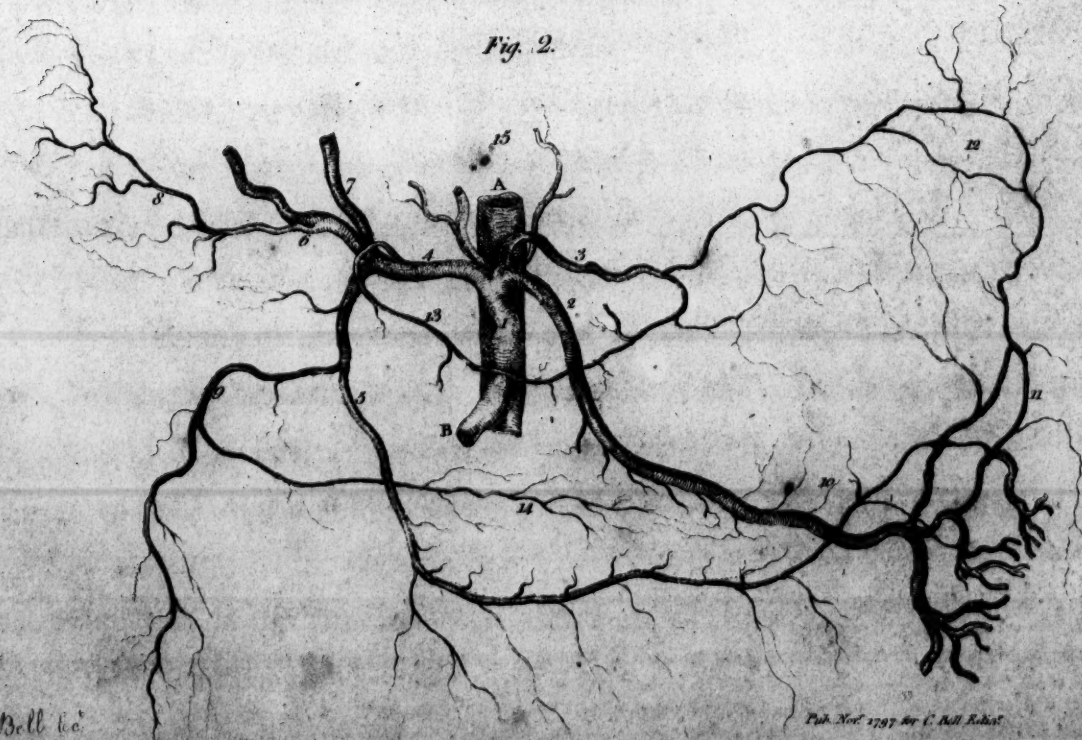


Fig. 2.



The COLICA MEDIA (G).—This branch goes directly upwards from the trunk of the upper mesenteric artery, as it comes out under the mesocolon. After running a little way upon the mesocolon, it divides; and the division going towards the right side, makes a large circle upon the extremity of the mesocolon, and forms a great anastomosis with the right colic artery; while the other division, going towards the left side, makes such another sweep, and joins with the left colic artery (T), which is a branch from the lower mesenteric artery. These two branches of the median colic artery give off numerous ramifications, which supply a great extent of the middle part of the colon.

The INFERIOR MESENTERIC (C).—The branches of the inferior mesenteric artery are easily found.—The dissection may be made backwards, from the hæmorrhoidal artery lying upon the back part of the rectum (H). Proceeding up along the gut, numerous branches are found distributed to that part of the intestine which forms the sigmoid flexure (I). These are derived from the uppermost branch of the lower mesenteric; as it supplies the left side of the colon, is called the COLICA SINISTRA (T); and, communicating with the median colic branch of the upper mesenteric, completes a great circle of anastomosis, reaching all the length of the intestinal canal*.

OF THE ACCOMPANYING VEINS SEEN IN THIS VIEW OF THE INTESTINES.—The branches of the veins run here in company with the arteries, however different they may be in the direction of their trunks. Therefore the names and distribution of the one set of vessels being known, the other must be known also;—for all vessels should be named from the parts to which they are distributed, and not from the trunks from which they are sent off; their distribution being constant, their derivation irregular.

The veins, as seen in this view of the parts, preserve a uniform course; their varieties consisting only in the direction of the trunks into which they are gathered to form the vena portæ.

Returning then upon the demonstration of the arteries. The HÆMORRHOIDAL VEIN, rising from the back of the rectum, may be easily found—the VENA COLICA SINISTRA, coming from the left part of the colon—the VENA COLICA MEDIA, following the artery of that name, and returning the blood from the arch of the colon—the VENA COLICA DEXTRA, towards the right side of the colon—and the VENA ILIO-COLICA, from the caput coli—then one great branch is seen promiscuously divided among the small intestines, and returning their blood to the vena portæ.

These veins are further traced in the next view of the intestines.

EXPLANATION OF PLATE III.

FIG. 1.—The colon, and contents of the pelvis, dissected out of the body, and their arteries, displayed.—A, The superior mesenteric artery, arising from the aorta—B B, The mesocolon—C, The inferior mesenteric artery—D, The branches of the superior mesenteric artery, which supplied the small intestines.

E E, The ilio-colic artery—F, The right colic artery—G, The median colic artery—H, The hæmorrhoidal artery—I, Branches going to supply the sigmoid flexure of the colon—K, The lumbar arteries, going off from the aorta—L, Common iliac artery—M, Middle sacral artery—N, External iliac—O, If-

* In the dissection of the lower mesenteric artery, its root is found entangled by the nerves of the lower mesenteric plexus, formed by branches from the sympathetic, by branches from the superior mesenteric plexus, and great celiac plexus. The lower mesenteric plexus, surrounding the trunk of the artery, sends branches out along the mesentery to the left side of the colon, and to the rectum.—I hope afterwards to have a better occasion of regularly detailing these nerves, and tracing them through their whole course.

chiadic arteries—P, Posterior iliac—Q, The pudic artery. It is seen sending off the middle hæmorrhoidal artery to the rectum; which, from its size, is more like its distribution in the female pelvis—R, Hypogastric artery. The ligament running up to S, shows the remains of the umbilical arteries—a a a, Arch of the colon—b, Sigmoid flexure of the colon—c, Caput coli—f, Rectum—g, Veins returning the blood from the penis—h, Prostrate gland—i, Vesiculæ seminales—k, Vas deferens, with the spermatic artery arising from the aorta, joining it where it is turning over the pin.

FIG. 2.—A plan of the distribution of the cœliac artery, affixing Plate IV.—A, Aorta—B, Upper mesenteric artery—1, Trunk of the cœliac—2, Splenic artery—3, Coronary artery of the stomach—4, Hepatic artery—5, Gastro-epiploic artery—6, Right hepatic branch—7, Left hepatic branch—8, Artery going to the gall-bladder—9, Pancreatico-duodenalis—14, Artery to the pancreas; and the twigs from the splenic artery may be seen coming to supply the gland—10, Vasa brevia—11, The left gastro-epiploic artery—12, Its inosculation with the coronary—13, Inosculation betwixt the right coronary and pyloric artery—15, Two phrenic arteries, arising in one trunk from the cœliac.

THIRD DISSECTION OF THE ABDOMINAL VISCERA,

Containing the Dissection of the Cœliac Artery,—of the Trunk of the Vena Portæ,—of the Arteries and Veins of the Stomach,—of the Liver, Gall-Ducts, and Pancreas.

SEPARATING the omentum from the colon, and leaving it connected with the stomach, cut away the great intestines. The rectum, as it descends into the pelvis, should be allowed to remain; for it belongs to the demonstration of the parts there.

There is now much difficult dissection. The stomach will be seen lying under the projecting liver; the spleen towards the left end of the stomach; and the pancreas under it, lying directly across the aorta, reaching from the spleen to the duodenum, and involved in much confusion.

The cœliac artery supplies all these parts lying in this upper division of the belly, above the mesocolon. It is the second artery of the abdominal aorta, coming off at the point where the great artery seems extricating itself from the diaphragm. It comes directly out from the aorta; a short trunk, quickly dividing into branches. (See Plan of the Cœliac Artery, Plate III. Fig. 2.)

The best way to dissect this artery is to lay down the stomach (as in Plate IV. Fig. 1.); and to dissect away the lesser omentum from betwixt the liver and stomach. The cœliac artery (Plate IV. Fig. 1. 1, and Plate III. Fig. 2. 1) is then found, dividing at once into many branches; and as they depart in different directions from one point, as from a centre, this is called the *AXIS ARTERIÆ COELIACÆ*.

The *ARTERIA CORONARIA VENTRICULI* will be found going off towards the left side (Plate III. Fig. 2. and

Plate IV. Fig. 1. 3), and spreading largely over the upper part of the stomach. If, in dissecting it where it goes off from the trunk of the cœliac, it is found to be larger than the other branches, then it may be expected to send a branch to the liver, and should be more cautiously dissected in that direction; viz. a little to the left, and then upwards, till it be lost in the FOSSA DUCTUS VENOSI of the liver. When there is no branch sent to the liver, it holds its course to the left or superior orifice of the stomach. Here it divides into two branches; one of which encircles the cardiac orifice, and anastomoses with the gastro-epiploic artery above the spleen; the other runs down the lesser arch of the stomach, sends a branch over the broad side of the stomach, and, continuing its course, anastomoses with the pylorica, or coronaria dextra. (See Plan of the Cœliac Artery, Plate III. Fig. 2. 13). In tracing these branches upon the lesser curvature of the stomach, they will be found complicated with the branches of the eighth pair of nerves, or PAR VAGUM, distributed to the stomach.

The ARTERIA SPLENICA (Plate III. Fig. 2. 2, Plate IV. Fig. 1. 2) arises from the trunk, or axis of the cœliac artery (1). It passes under the stomach, and along the borders of the pancreas, where it gives off the PANCREATICÆ PARVULÆ. Continuing its serpentine course, it gives the VASA BREVIA (10) to the stomach, and small branches to the mesocolon. When it reaches the spleen (Plate IV. Fig. 1. g), it makes a curve in its bosom, and enters it in several branches. It sends off from its branches in the spleen, a more considerable branch (11) to the stomach; which, anastomosing with the gastro-epiploic artery (5), is called the GASTRO-EPIPLOICA SINISTRA.—The artery of the spleen is tortuous; probably to allow the dilatation of the stomach: For it is not the force of the blood in the artery which curves it, or makes it tortuous; nor does this seem a provision for breaking the force of the blood, as the vein also is tortuous.

The ARTERIA HEPATICA (Plate IV. Fig. 1. 4, and Plate III. Fig. 2. 4) runs in a direction opposite to the splenic artery, towards the right side. After having run some way in the direction of the trunk of the vena portæ, it divides, nearly at the same place, into four important branches, spreading over the trunk of the vena portæ.

BRANCHES OF THE ARTERIA HEPATICA.—First, There is sent off the ARTERIA GASTRO-EPIPLOICA (5), so named from its chief branch; or sometimes called the DUODENO-GASTRICA, from that branch of it (Plate III. Fig. 2. 9) which goes to the duodenum. This artery, descending under the pylorus to gain the great curvature of the stomach, with its accompanying vein, it catches the eye while the viscera are yet entire. It is seen beautifully distributed to the stomach and omentum; and reaching the left and obtuse end of the stomach, it anastomoses largely (11) with the splenic artery. As this gastro-epiploic artery runs across the under side of the duodenum, the PANCREATICO-DUODENALIS (See Plate III. Fig. 2. 9) is sent off. It runs down the intestine, and sends a considerable branch (14) along the pancreas.

The hepatic artery (Plate III. Fig. 2. 4), after sending off this branch, almost immediately divides into the right and left hepatic branches: And from the left branch is sent off the CORONARIA DEXTRA (Plate IV. Fig. 1. 8); which, turning backwards, spreads its branches upon the pyloric end of the stomach, anastomosing with the proper coronary of the superior orifice, and with the pyloric arteries, which are numerous and important twigs from the surrounding greater arteries. This artery sometimes comes off from the trunk of the hepatic artery (as in the Plan of the Cœliac, Plate III. Fig. 2). The left hepatic artery (Plate III. Fig. 2. 7, and Plate IV. Fig. 1. 7), climbing upon the vena portæ, enters the liver, and, separating into branches, continues attached to the great vein, and is distributed within the liver to the whole of the left lobe, the lobe of Spigelius, and part of the right lobe. The right hepatic branch (Plate IV. Fig. 1. 6, and Plate III. Fig. 2. 6), passing under the hepatic duct of the liver (K), is distributed to the right lobe of the liver and the gall-bladder.

In dissecting the root of the cœliac artery and the aorta, betwixt it and the superior mesenteric artery much confusion arises, from the meshes of the cœliac ganglion, and the branches coming to it from the semilunar ganglions of the splanchnic nerve, from the sympathetic nerve, and from the eighth pair

upon the stomach. From this ganglion an immense number of smaller nerves are sent out, forming lesser ganglions, along the mesentery, to the duodenum, liver, spleen, &c. ; but plans for the dissection of these nerves will be given in the succeeding part of this edition.

OF THE VENA PORTÆ.—The vena portæ is formed by the gathering together of the veins from the intestinal canal, and from the spleen and pancreas of the solid viscera. Near the liver these are collected from three great branches, answering to the celiac, upper and lower mesenteric arteries. The trunk of the vena portæ (Plate IV. Fig. 1. E) lies obliquely across the spine. The branch answering to the celiac, is the splenic vein (B). It forms one of the great arms of the vena portæ in the belly ; it is carried in the direction of the main trunk ; it gathers the blood from the spleen, stomach, pancreas, and omentum.

The veins coming up from the lower part of the belly, answering to the mesenteric arteries, are the mesenterica major (D), and the mesenterica minor (C). All the veins from the mesentery, and from one half of the colon, meeting together, form the first of these ; which, from its size, is the most important vein of the intestines. Its branches run in company with the extremities of the superior mesenteric artery, as they are spread from the duodenum, along the tract of the intestines, to the middle of the colon. It joins the trunk of the vena portæ.

The vena mesenterica minor (C) carries back the blood from the left side of the colon, and from the rectum, accompanying the lower mesenteric artery in its whole course ; and from the branch which mounts up upon the back of the rectum, it has been called the hæmorrhoidæ interna. This vein joins sometimes with the splenic (B), more commonly with the mesenterica major (D). As the great mesenteric vein goes up under the duodenum, it receives the veins of the pyloric orifice, and those answering to the pancreatico-duodenal artery : and as the trunk of the vena portæ runs across the spine towards the liver, it receives the veins from the right side of the duodenum, and lesser arch of the stomach, answering to the lesser coronary, or right coronary of the stomach ; then mounting obliquely upwards, and towards the right side, it enters the porta of the liver, and dividing at (E) into two great branches, forms the great sinus of the liver.

In dissecting these veins, there is much cellular substance to be cleared away ; and it is not easy, if the injection be at all brittle, to dissect upon their thin coats, without cutting them, or breaking the injection.

As the vena portæ approaches the liver, it runs parallel to the ducts and the hepatic artery. They are here included in one sheath of cellular substance, viz. the capsula glissonii. This was formerly thought to assist the circulation of the blood in the liver, by giving a pulsation to the vena portæ ; which was in all probability suggested, by observing the pulsation of the hepatic artery within this covering, in opening living animals.

The vena portæ, then, is a vein performing the office of an artery in the liver, by distributing in it that blood which it collects from the arteries of the intestines. But the proper veins of the liver, the branches of the vena cava hepatica, return their blood directly to the heart. These in their extremities (Plate IV. Fig. 1. H H), are distributed much like the vena portæ ; but upon dissecting the under surface of the liver, they are found, when gathered into trunks, to turn away from the porta, and run up towards the attachment of the liver to the diaphragm, and enter into the inferior cava very near the heart.

The lymphatics can be nowhere so easily found as upon the surface of the liver (where they resemble the traces left by steam condensed and trickling down an inclined surface), or in the cellular substance accompanying the great vessels of the liver, or on the gall-bladder and ducts.

The gall-bladder (Plate IV. Fig. 1. I) will be found on the under surface of the liver, half sunk into the substance of the gland ; and when the liver is in its place, it is nearly horizontal. It is touched by the duodenum and colon, as the tinging of the bile in bodies opened sometime after death, demonstrates.

There are often adhesions betwixt the gall-bladder and colon. The gall-bladder is sometimes greatly increased in size; yet the quantity of bile contained in the bladder is nothing to what is suddenly vomited in some diseases.—The hepatic biliary duct (Plate IV. Fig. 1. and Fig. 2. K) comes from the substance of the liver; runs by the side of the great vessels; and is large, compared with the cystic duct (Fig. 2. L), which does not come off directly from the gall-bladder, but turns up a little upon its smaller end (at M), before it descends to meet the other duct, which it does at an acute angle. They run some way together before they join to form the ductus communis choledochus (Fig. 4. N). This common duct, separating from the vena portæ, runs down, obscured by the pancreas, behind the duodenum, and betwixt the lamina of the mesocolon; then entering the coats of the duodenum, it runs someway betwixt them before it opens into the cavity of the gut*; it generally enters by the same mouth by which the duct of the pancreas enters, although sometimes they enter separately. The gall-bladder and ducts may be injected from the common duct, or the bladder; and all the ducts may be filled, by introducing the pipe into the bladder behind, so as not to injure the appearance of the preparation. The nerves of the liver are very minute, answering to its insensibility; though such correspondence, by no means, holds uniformly. They come from the eighth pair, and great sympathetic, running in two divisions, with the hepatic artery before, and with the vena portæ behind. There are likewise some twigs from the anterior plexus of the stomach.

As the opening of the common duct (Fig. 2. N) into the intestine is apparently the easier passage, how is the bile collected in the cyst? The use which is naturally suggested to us, is, to prevent the perpetual discharge of the bile into the intestine, and to reserve it to be mixed with the food as it passes the duodenum. But it is not easy to determine how this is done;—whether by the distention of the intestine, and consequent pressure upon the gall-bladder; or by the contraction of the gut, and consequent opening of the mouth of the duct;—or whether it be not an irritation of the mouths of the ducts themselves, by which the discharge into the intestine is regulated, and even the secretion promoted. A calculus in the common duct must, if not discharged, disorder the whole system; but the cystic duct being smaller and more valvular, concretions formed in the bladder, if they pass the cystic duct, can generally pass the common duct. When there are calculi in the hepatic duct (as represented in Plate IV. Fig. 2. o), the ducts which ramify in the liver must be enlarged; while the ducts below (k) must shrink, and even the bladder (I) and cystic duct (L) must shrink.—When the cystic duct is obstructed, then the gall-bladder shrinks; and when the common duct, then it is enlarged. There are cases of calculi making their way out by the umbilicus, and leaving a little ulcer, discharging a yellow lymph. This happens by the enlargement of the gall-bladder, and its adhesion to the integuments. In the *Memoires de Chirurgie*, a case is given by Petit; who was so bold as to operate upon a circumscribed tumor, presenting at this place; from which he extracted a calculus, and relieved his patient from extreme agony. But for the most part, those extraordinary cases of knives cut from the stomach, and bodkins from the groin, and stones from the gall-bladder, which at first seem impossible, are but the opening of a superficial abscess, where the foreign substance, having gradually made its way outwardly, is almost protruding; and it is only in such a state of the parts that the operation can be performed.

There are several instances of worms getting into these ducts from the intestines, and even nestling and adhering in groupes.

* To understand the valve of the lower orifice, and the entrance of the biliary and pancreatic ducts, open the duodenum, and examine it in water.

EXPLANATION OF PLATE IV.

FIG. 1.—a a a, The liver in outline—b, The round ligament, which is the remains of the umbilical vein—c, The broad ligament of the liver—d d, The stomach distended, showing the vessels ramifying upon its surface—e, The duodenum.

In this view, the splenic vein is cut, to allow the distension of the stomach.—A, marks the vein coming out from the spleen—at B, it is seen running towards the vena portæ—C, The trunk which returns the blood from the lower mesenteric artery—D, The trunk answering the distribution of the upper mesenteric artery—E, The trunk of the vena portæ, formed by the three branches B, C, D—F, Remains of the umbilical vein—G G, The cava abdominalis, running up behind the liver to receive the hepatic veins H H—I, The gall-bladder, with the cystic duct reaching down from it to join the hepatic duct K—L, The trunk of the celiac artery—2, The splenic artery—3, The superior coronary artery—4, The hepatic artery—5, The gastro-epiploic artery—6, The right hepatic artery, sending off the cystic branch—7, The left hepatic artery, sending off the pyloric artery 8—g, The spleen.

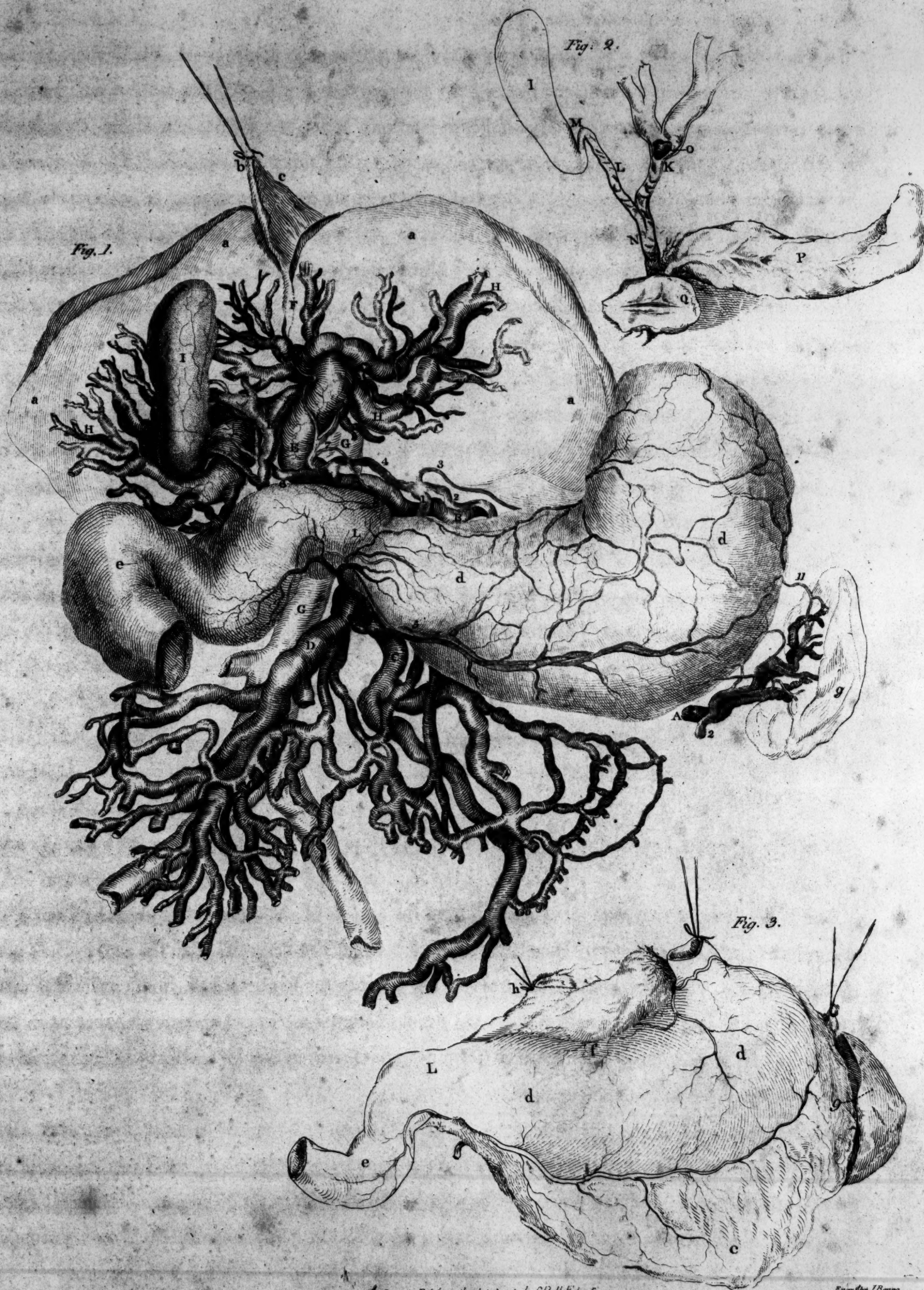
FIG. 2.—The gall-ducts and pancreas.—I, The gall-bladder—K, The hepatic duct—L, The cystic duct—M, An acute turn of the cystic duct, reflected upon the gall-bladder—N, The common duct—O, A stone in the hepatic duct—P, The pancreas, seen upon its under side—Q, Part of the duodenum.

FIG. 3.—The stomach, with the omentum and spleen.—d d, The stomach—c, The omentum—e, The duodenum—L, The pyloric orifice—h, The cardiac orifice—f, The lesser curvature of the stomach, with the little omentum attached to it—g, The spleen.

PECULIARITIES IN THE SITUATION OF THE VESSELS OF THE ABDOMEN.

THE vena portæ, which receives the blood from the arteries of the abdominal viscera, is like the other veins of the body, comparatively of a larger size, and thinner in its coats, than the arteries. It gathers its branches into one great trunk: but when it has got into the liver, though it retains the character of a vein in the thinness and inactivity of its coats, yet it assumes the office of an artery; for it again divides into branches; and its blood does not flow from its extremities towards its trunk, but, like that of an artery, from the trunk towards the extremities.

To account for this further propulsion of the blood, the muscularity of the coats of the vein, and the alternate action of the abdominal muscles, is suggested in almost every book. But the coats of a vessel, though endowed with muscular power, can give no assistance in propelling the contained fluids, unless an alternate action be allowed. Now the veins having no pulsation, their muscular fibres contract their diameter only till the force of contraction is equally opposed by the force of the circulating blood; and they then become like rigid tubes. If, therefore, the muscular fibres of the veins are proved to exist, and supposed to accelerate the blood, a pulsation must be allowed also. Ingenious men may perplex even the plainest truths; but that the veins have no pulsation cannot be long a question, when the action of the heart and vessels is attended to. The uniform flow of blood in the veins is generally accounted for, from the supposed effect of the blood in a vein receiving the impulse of the heart by channels of unequal





lengths. But, though this may account for it, perhaps a still more satisfactory reason may be drawn from considering the consequence of the action of the two accelerating powers, the heart and arteries. The pulsation of the heart, by a gradation of forces, which it would be tedious to explain, is continued into the extremities of the veins. This is a fact acknowledged by all who wonder how the veins, like the arteries, do not answer to the stroke of the heart. The blood is carried forward to the beginning of the veins by the contraction of the heart, at the same time that the arteries are dilating; and the arteries being dilated, they immediately contract, and push their blood into the veins, which, alternating with the contraction of the heart, causes not an interrupted stream or pulsation, but a continued flow. The arteries beat, because they receive a pulsation from the heart's contraction; but the veins, being beyond the arteries, receive the force of contraction both of the heart and arteries; and these, succeeding each other without interval, make a continued stream in the veins. To use a familiar example, they are in the situation of the nozzle of a double bellows.

If it were asked of those who say that respiration mechanically assists the circulation of the blood in the abdomen, whether these veins are more compressed during the contraction of the abdominal muscles, or during that of the diaphragm? they would hesitate; for there have been no experiments to ascertain whether the pressure upon the abdominal viscera be uniform or not. And surely, from considering the alternate action of the diaphragm and abdominal muscles, the one receding while the other acts, we must conclude that there is an uninterrupted pressure: and before it can be said that even the violent efforts of vomiting and coughing compress the abdominal veins, or accelerate their blood, the state of the thorax in the same actions must be considered, and whether the pressure there be not equal to that in the abdomen. (See Observations upon the Action of the Diaphragm, Part II.—) That a degree of pressure kept upon these veins by the abdominal muscles and diaphragm, is necessary, we know, from an old observation of Bartholine, confirmed every day, that, upon opening the belly of a living dog, he observed the veins gradually swell, and become monstrously distended. There are frequent opportunities of observing, in the human body the consequence of this tension being taken off; as in the evacuation of the waters in dropsy and in child-birth, and even in the sudden discharge of wind from the intestines. In lighter cases, it is attended by a peculiar faintish feeling. Sometimes it proves fatal. In one case, recorded by the younger Du Verney, the operator, mistaking for dropsy a habitual distension of the intestines with air, pushed his trochar into their cavity: the air rushed suddenly out, the abdomen became flaccid, and the patient died in a very short time. There are other cases, where the patient being wasted and feeble, a sudden discharge of wind by stool has occasioned sudden death.

FOURTH DISSECTION OF THE ABDOMEN.

THE cavity of the abdomen should now be freed from all the complication of the viscera. But still a tedious dissection is required to show the muscular and tendinous parts of the DIAPHRAGM,—the passages for the VENA CAVA, the OESOPHAGUS, and AORTA—to display the MUSCLES OF THE LOINS,—the KIDNEYS and URETERS,—the VENA CAVA, and the general distribution of the AORTA.

The DIAPHRAGM is the septum which divides the thorax from the abdomen. It arises muscular from the borders of the chest, and tendinous from the vertebræ of the loins. But it has no insertion; its action is within itself; it moves no parts, as other muscles do, but, by its contraction, alters its own convexity. Before opening the thorax, it may be seen how the middle part of the diaphragm is retired up

into the thorax, forming a large concavity, which receives much of the abdominal contents; and how it is sucked up, and made tense, by a vacuum in the thorax. In this state, if the thorax be opened or punctured, the diaphragm is seen to fall flaccid and loose. Observing this, the effect of the action of this muscle must be easily understood: that, by the contraction of its muscular part, the arch which it forms into the thorax approaches to a plane, dividing the two cavities, and consequently enlarging the capacity of the thorax, and allowing the lungs to receive the atmospheric air. The great muscle of the diaphragm, as it arises from the borders of the chest on the inside, should be first dissected. This extensive origin is to be followed round to the false ribs, and where it approaches the spine, a kind of ligament is found passing from the twelfth rib to the vertebræ, forming an arch over the upper part of the psoas magnus. This, the *LIGAMENTUM ARCUATUM*, it will probably be found difficult to demonstrate satisfactorily; for the fibres of the diaphragm here are strong, yet loose and flabby, and not easily dissected, as it lies under the kidney, and under much loose cellular substance, and soon spoils. Down upon the spine, an irregular sheath of tendons will be found, lying flat and silvery, and arising from the ligaments of the lumbar vertebræ. These origins, or feet of the crura of the diaphragm, may be counted: but it is more important to observe the muscle connected with these tendons, viz. the *SMALLER* and *POSTERIOR* muscle of the diaphragm; and how these crura stretch over the aorta, and surround it; while, by the direction of their fibres, they are prevented from compressing the great artery. These muscular fibres, after passing the aorta, mingle; but they again separate to give passage to the œsophagus, and again intersect each other above the œsophagus.—The central tendon is the tendon of this great circle of muscle. The fibres composing it are intricate, and form irregular interlacements, which yet keep a wonderful similarity in different subjects. Through this central tendon the vena cava pierces, to go up into the thorax. Here there are no muscular fibres, the passage being large and free.

The fleshy muscle filling up the space at the side of the spine, is the *PSOAS MAGNUS*. It is very strong, supporting the trunk upon the lower extremity, and moving the thigh upon the pelvis. Its uppermost origin is from the last vertebræ of the back; at which place it is covered by the diaphragm: from this point downwards to the sacrum, it arises from the transverse processes and sides of the vertebræ; which origins are concealed by its belly. It runs under Paupart's ligament out of the belly, and turns over the head of the thigh bone to be inserted into the lesser trochanter of that bone.—The tendon of the psoas parvus will be found running down on the inside of the belly of the great muscle. The iliacus internus, filling up the cup of the ala ilium, may be dissected at the same time, as it accompanies the psoas, and has the same insertion.

To follow these at present to their insertion, would be encroaching too much upon the dissection of the thigh.

To dissect the great vessels of the belly, when injected, is no very difficult matter; for it is but cleaning away the cellular substance from them. It may be observed how the aorta comes out under the diaphragm. It enters the abdomen upon the left side of the spine; but proceeding downwards, it shifts more towards the middle of the spine.

The vena cava in the upper part of the belly, as in the breast, does not lie close to the back-bone; but proceeds from below upwards, upon a higher level, towards the perforation of the diaphragm.

The abdominal branches of the aorta may now be enumerated. 1. The phrenic arteries, sent off as it passes under the diaphragm, or perhaps from the coeliac artery, (as in the Plan, Plate III. Fig. 2.): 2. The coeliac artery, sent off to the stomach, liver, and spleen: 3. The superior mesenteric artery: 4. The emulgents, one sent off on each side to the kidneys: 5. The lower mesenteric artery.

Besides these, the aorta gives off the lumbar arteries, which are seen dipping under the psoas magnus of each side. As the emulgent arteries go off from the aorta betwixt the superior and inferior mesenteric

arteries, it happens that all the great arteries of the viscera are sent out within a very small space ; and at this point aneurisms of the abdominal aorta are most frequently found.

Before the emulgent arteries enter the kidneys, they give off small branches to the glandula atrabilia (which are small triangular bodies, seated like a cape upon the upper end of the kidney, and which dwindle in the adult), and also to the fat surrounding the kidney. The parts surrounding the kidney likewise receive arteries from other sources, even from the phrenic arteries ; and besides, each of the small glands attached to the kidney has an artery, peculiarly its own, coming from the aorta, at the root of the upper mesenteric artery. On the fore part of the aorta will be found small twigs, running to supply the lumbar glands. But the arteries which there is most danger of destroying, are the SPERMATIC ARTERIES, which are extremely small, running down parallel to the aorta. The left spermatic artery comes more frequently from the emulgent artery than from the side of the aorta ; the right more generally from the side of the aorta. The artery of each side, running down along the psoas muscle, is joined by its accompanying vein from the emulgent or renal veins : then descending, it courses round the brim of the pelvis to the abdominal ring, where it meets the vas deferens as it is about to drop down into the pelvis to join the vesiculæ feminales upon the neck of the bladder.—The emulgent, and consequently the spermatic, veins do not empty themselves, like the veins of the other abdominal viscera, into the vena portæ, but into the vena cava inferior : so do all the veins of the solid walls of the abdomen. The spermatic veins are the only vessels within the abdomen having valves, which shows a strange provision for their descent out of the abdomen into the scrotum.

To describe, in this dissection, the nerves which must be cut ; how the anterior crural nerve is composed ; the connections of the intercostal nerve ; and the numerous and intricate branches going to the muscles of the loins and belly, would lead to a long, and, I trust, superfluous discussion ; since they must be regularly detailed in the other Numbers, whilst this has been carried beyond its due length.—It may, however, be remembered, that to dissect these nerves completely, so as to have a comprehensive view of them, the ribs of one side must be cut far down, the diaphragm separated from the margin of the ribs on the same side, while it is kept attached at its tendinous origins from the lumbar vertebræ, and held out so that the side of the spine may be seen in the thorax, and down to the pelvis : then the kidney being lifted from its seat, let it be held out, attached only by the ureters and emulgent vessels. In this situation of the parts, the sympathetic, and its connections with the spinal nerves, may be dissected in the thorax, above the diaphragm ; and the anterior branch or splanchnic nerve, sent off in the thorax, can be traced through the diaphragm to the ganglions about the root of the celiac artery ; and the continuation of the sympathetic nerve may be seen running, near the root of the ribs, down the spine. As the sympathetic descends, it comes more towards the fore part of the bodies of the vertebræ : here it receives additions from each lumbar ganglion, and sends at the same time numerous small branches over the great vessels, and finally ends in the numerous and delicate plexus within the pelvis.



A
S Y S T E M
OF
D I S S E C T I O N S.

P A R T II.

CONTAINING

THE ANATOMY AND DISEASES

OF THE

T H O R A X.

WITH PLATES.

SECOND EDITION.

BY CHARLES BELL, SURGEON.

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1800.

SYSE M

DISSECTIONS

PART II

THE ANATOMY



A
S Y S T E M
OF
D I S S E C T I O N S.

D I S S E C T I O N S

OF THE

T H O R A X.

THE present subject shall be divided in such a way, that each branch of it may be comprehended in one dissection, or view of the parts, as they lie in the dead body : And those points of the anatomy shall be chiefly dwelt upon which are useful in dissection, or in understanding the local or organic diseases.—The two first dissections of the thorax naturally include the muscles and blood-vessels which lie upon the breast and lower part of the neck ;—then, proceeding to the viscera, the appearance of the heart, lungs, and mediastinum, upon lifting the sternum, makes the second division ;—next the manner of displaying the heart is to be explained ;—afterwards the injection of the heart, with the dissection of the great vessels proceeding from it.—Lastly, the morbid anatomy of the breast will solicit attention :—first, aneurisms, and the diseases of the heart and larger vessels, with the circumstances which are to be observed in the dissection of those diseases ;—and, secondly, the diseased appearances of the lungs, of the pleura, and of the cavity of the chest in general.

It may, however, be proper further to observe in this place, that in explaining the situation of the heart and great vessels, and the play of the lungs, it is impossible to overlook the deficiencies in the accounts that are given of the mechanical action of the heart and vascular system, and of the effect of respiration upon the action of the heart, or rather of the manner in which its effect upon the heart and veins is counteracted. And it surely will not be thought too great a departure from the plan and limits of this book, to touch slightly upon these important points ;—they are points susceptible of such clear explanation, that they must be considered rather as hitherto neglected than as misunderstood.

FIRST DISSECTION OF THE THORAX.

The Dissection of the Muscles and Blood-vessels which lie upon the outside of the Chest, and lower part of the Neck.

NOTHING confounds a person more in dissection than an ignorance of the parts which immediately surround that upon which he is employed : therefore, in explaining the dissections of the outside of the chest, it is proper to point out, not only the muscles, and the branches of arteries which lie upon the chest, but those likewise which lie in the axilla, and upon the neck, as being strictly connected with them in every useful inference to be drawn from the anatomy of this part.

To follow the dissection as represented in Plate V. (which is scrupulously drawn from the subject), make an incision from the thyroid cartilage down the middle of the sternum, and extending below the scrobiculus cordis ; then make an incision in the direction of the clavicle, and over the top of the left shoulder. In dissecting the integuments of the breast, carry the knife in the direction of the last incision ; by which the pectoralis major muscle (a b c), and the deltoid muscle (d), will be smoothly dissected in the direction of their fibres.

No fascia will be found expanded over the muscles which lie upon the chest ; but the fibres of the muscles are separated from the fat lying under the skin by a thin aponeurosis of an opaque and milky whiteness in children, which adheres closely to them, and is not easily dissected away, unless very regularly done, as the dissection of every muscular part ought to be. The PECTORALIS MAJOR arises from the fore part of the clavicle (e), from the sternum (c c), and from the cartilaginous endings of the fifth and sixth ribs (b f). From the origins of such extensive flat muscles as this, the fibres are generally prolonged into fasciæ, scarcely distinguishable from the common membrane. Of this kind are the fibres which stretch across the sternum from one pectoral muscle to the other, and are connected with the periosteum. So considerable is the membrane resulting from the extended margins of the PECTORAL MUSCLE (b f), the SERRATUS ANTICUS (g g g), the RECTUS (h), and OBLIQUUS ABDOMINIS (i i)—that they may all be lifted at once from the ribs, and yet be preserved attached to each other. A slip (b), taking its origin from the sixth rib, goes up to the pectoral muscle (a k). The fibres of the pectoral muscle are seen converging to form the tendon, by which, turning round into the axilla, it is inserted into the arm-bone. It will be observed, that the upper portion of the muscle, arising from the clavicle (e a), descends, in a direct line, to its insertion at (l) ; while that portion of the muscle which comes from the lower part of the breast (k) twists as it goes round into the axilla, and is inserted into the arm-bone, nearer its head than the part of the tendon at (l) answering to the upper margin of the muscle (a).

The origins of the OBLIQUUS DESCENDENS ABDOMINIS are marked (i i i).—The SERRATUS MAJOR ANTICUS (g g g), is laid like a hand broad upon the chest, with its digitations extending upon the ribs. It is thin and flat where it arises by its serrated origins (from all the true ribs except the first, and from three of the false ones) : but as it retires under the latissimus dorsi (m), its fibres converging, it acquires a considerable thickness. It is inserted in the backmost edge or base of the scapula.





Drawn by Chas. Bell

Engraved by J. Knight

Pubd April 1798 by Charles Bell Esq.



For the origins of the *OBLIQUUS DESCENDENS ABDOMINIS* (i i), and of the *RECTUS* (h), see the dissection of these muscles, page 3, and 4. The *DELTOID MUSCLE* (d d) covers the shoulder-joint with a fleshy cushion. It is naturally divided into three portions by cellular membrane and fat: one division comes from the clavicle; another from the acromion process of the scapula; a third from the spine of the scapula. It is inserted by a short tendon, encircling the arm-bone about one-half of its length from the head.

OF THE BLOOD-VESSELS CONNECTED WITH THE DISSECTION OF THESE MUSCLES.

Between the deltoid and pectoral muscles there is found cellular membrane and fat; and from the upper part of this interstice, and near the clavicle, a considerable branch of an artery (1) comes up from the subclavian artery, and is distributed over the shoulder and upper part of the pectoral muscle. This is the *RAMUS SUPERFICIALIS ARTERIÆ THORACICÆ ACROMIALIS* of Haller, or a branch of the third thoracic artery, as commonly enumerated. If this branch be dissected towards its origin (by separating the pectoral and deltoid muscles), its branches under the pectoral muscle will be seen, and also the trunk of the subclavian vein (2) originating from the basilic and cephalic veins; and behind it the subclavian, or rather, as it proceeds downwards, the axillary artery (3). It is here, in the angle of the joining of the clavicle (n) with the acromion process (o) (which projects upon the top of the shoulder and over the head of the arm-bone), that the attempt to compress the axillary artery is to be made in operations upon the joint, &c.; or the attempt is made above the clavicle, and at the outer edge of the origin of the mastoid muscle (q) from the clavicle. The situation of this artery is better seen in the next Plate (3), where the pectoral and deltoid muscles being taken away, it is seen defended in part by the clavicle (E), and passing under the pectoralis minor (L).

Upon the fore part of the pectoral muscle, again, several small twigs of arteries will be found coming up through the interstices of the ribs (4 5 6). These are branches of the internal mammary artery, which through its whole course is seen (4 4 4) in the Additional Plate VI. These, when minutely injected, are seen anastomosing freely with each other, and with the twigs sent from the axillary and subclavian arteries. The arteries coming round from the axilla by the lower edge of the pectoral muscle are the extremities of the long thoracic artery (a branch of the axillary artery), which is also called the pectoral or external mammary artery (7). In the next figure it is marked 8.; it is there raised from its course upon the ribs.

All these arteries (and chiefly the last mentioned branch) throw out their blood in the extirpation of the mamma. The intricate situation of the axillary glands (8) should be observed, that it may be understood how far these glands, being enlarged and diseased, may encroach upon the trunk of the axillary artery. A very accurate and useful view of the axilla is given in the First Plate of the Second Volume.

In dissecting above the clavicle, and in carrying back the flap of skin from the side of the neck, in the angle between the sterno-cleido-mastoideus muscle (q r) and the trapezius (s), the fat will be found in most subjects loose and watery, and of a granulated appearance, especially in young subjects. This confused fatty mass must not be taken away rudely, for under it lie many important parts*. The *EXTERNAL JUGULAR VEIN* (9) will be found close by the outer edge of the mastoid muscle, and passing under the clavicle at the angle formed with it by the origin of the mastoid muscle (q), to join the subclavian vein, a considerable artery (the *TRANSVERSALIS COLLI*, a branch of the lower thyroid) will be observed (10),

* These parts are more fully discussed in the Second Part of Volume II.

ending its branches all over the side of the neck, and round under the trapezius muscle. Betwixt this artery and the root of the external jugular vein, the OMO-HYOIDEUS MUSCLE (t), a long and flat muscle, will be seen passing obliquely upwards at (v), to the os hyoides; and as it goes under the mastoid muscle, it may be seen degenerating into a middle tendinous part. Under this muscle again, and from betwixt the origins of the scaleni muscles (w), the cervical nerves are seen descending to form the axillary plexus. The small lymphatic glands (11), the GLANDULÆ CONCATENATÆ, may be observed lying upon the side of the neck. And further, it may be observed, that the small nerve (13) which passes backwards over the mastoid muscle, and which lies close to the muscle and under the branches of the external jugular vein, is the NERVUS ACCESSORIUS, which comes out from the skull in union with the eighth pair. Lower down, behind the mastoid muscle, and lying upon the scaleni muscles, there is found a delicate nerve (12), resulting from the cervical nerves; and this is the phrenic or diaphragmatic nerve, which should be carefully preserved for the demonstration of the nerves of the thorax.

It will be immediately understood how this part of the root of the neck, and just over the clavicle, forms the most deadly aim of the assassin; for his knife passes at once into the breast, and pierces the great vessels near the heart.

More towards the fore part of the neck we may observe the following parts. Upon lifting the mastoid muscle a little from its seat, and holding it aside, the continuation of the omo-hyoideus muscle (v) is seen passing upwards, and spreading into a second belly. Under this the CAROTID ARTERY (14) and JUGULAR VEIN (15) are found lying in their sheath; and betwixt them the PAR VAGUM, or eighth pair of nerves (16). A little more towards the fore part of the trachea a small nerve is found coming down from the root of the tongue, and from under the angle of the jaw, viz. the DESCENDENS NONI (17).

Upon lifting back the mastoid muscle, the flat ribbon-like muscles of the throat are found so accurately laid upon each other, and embraced and connected by the cellular substance, that the individual muscles are scarcely to be distinguished before dissection. The thyroid veins, lying upon the fore part of the throat, should be preserved; they run down in a direct course from the thyroid gland to the trunk of the left subclavian vein as it crosses the top of the chest.

If the whole side of the breast and neck be thus regularly displayed, there will be no difficulty in lifting the outer layer of muscles, and dissecting the lesser pectoral muscle and subclavian muscle, and all those parts which are seen in the next dissection.

OF THE MAMMA.

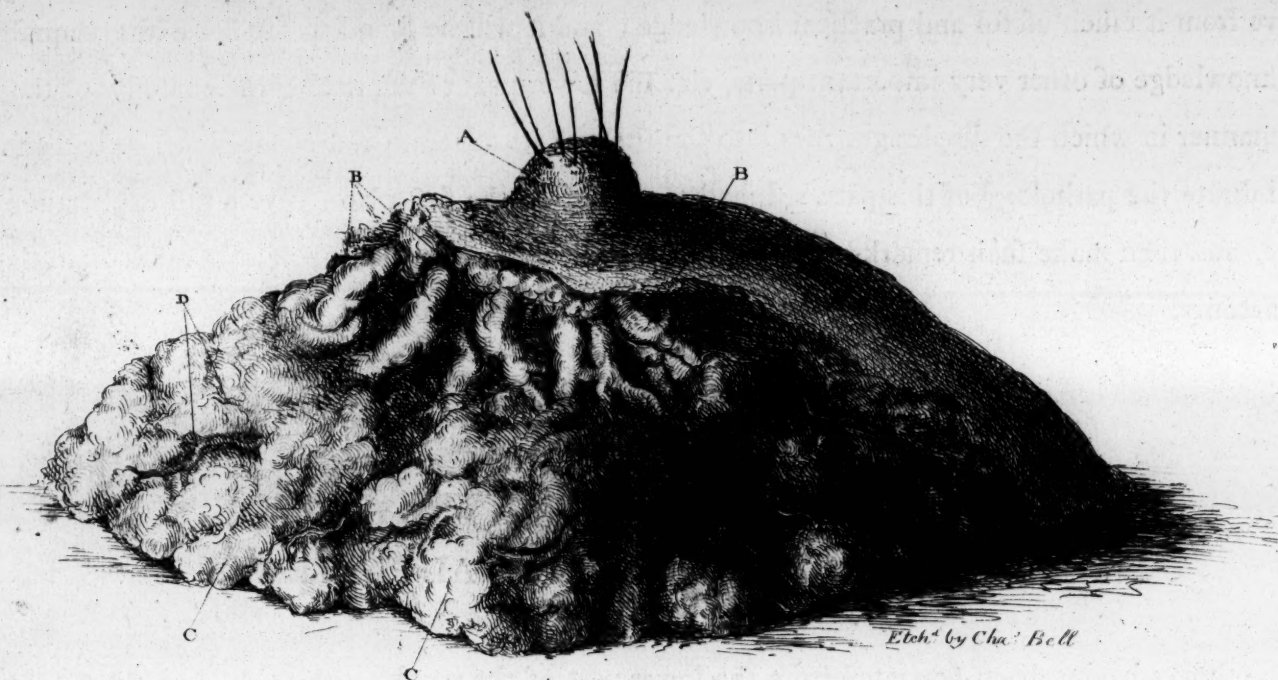
The mamma in the female subject should be attended to. It is seated on the great pectoral muscle. Its bulk is greatly made up of the fat which surrounds the proper gland. The central glandular part is a congeries of lesser glands connected by their ducts and vessels, and invested in a cellular membrane. It has its arteries, 1st, from the internal mammary artery, the branches of which, spreading betwixt the pleura, pass from betwixt the ribs, and through the pectoral muscles, into its substance. 2d, From the external mammary or thoracic arteries, branches of the subclavian artery. 3dly, From the intercostal arteries. These become more important branches, from their increased size, when the gland is diseased, hardened, and enlarged.

They all form anastomosis with each other. The external mammary artery also forms a very remarkable anastomosis with the epigastric, by which Boerhaave and Whyte explained the sympathy of the womb and breast; a connexion which surely depends upon other laws of the economy. The veins are

very numerous, and pass superficially under the skin. In women giving suck, they become enlarged, and very evident.

The lobulated structure of the gland has much of the cellular membrane interposed ; and this adipose membrane both invests the gland on the outside, and also connects it with the pectoralis major. The lymphatics run towards the axilla, and pass through the axillary lymphatic glands, which are seen in the first Plate of Volume II. These glands are consequently affected when the mamma is diseased.

ETCHING OF THE INJECTED BREAST.



A, The NIPPLE, or PAPILLA. B, The LACTIFEROUS DUCTS, injected with mercury. It is only when distended that they take this irregular varicose-like form. C C, The lobulated appearance of the gland. D, The extremities of the ducts. The milk during nursing being continually secreting into these ducts, is collected gradually into the more varicose and dilated parts, D. The ducts again contract before they pass into the nipple, and the structure of their orifices is such, as only to allow the milk to pass when the nipple is drawn out by the sucking of the child. The areola, or dark-coloured zone surrounding the nipple, is of a paler colour in girls ; it changes to a darker colour during menstruation in women with child, or when giving suck. It has a glandular structure to prevent its excoriation, which, however, subjects it to ulceration and disease, like other glandular parts.

K

SECOND DISSECTION OF THE THORAX,

Being the Continuation of the Dissection of the Blood-Vessels and Muscles.

If we pay sufficient attention to that stage of the dissection which the annexed Plate represents, we shall derive from it much useful and practical knowledge; and it will be found to facilitate the acquisition of the knowledge of other very important parts, viz. the lower part of the neck; the anatomy of the axilla; the manner in which the diaphragm rises into the thorax; its structure and connections. It will also greatly illustrate the pathology of this part. I shall therefore, in the first place, give a full explanation of the Plate, and then make such remarks as I think may be useful, and which necessarily result from this piece of anatomy.

EXPLANATION OF ADDITIONAL PLATE V.

The thorax having been separated from the lower part of the trunk; the CLAVICLE, the SCAPULA, the LESSER PECTORAL MUSCLE having been dissected, and left on the left side in their natural situation; the diaphragm likewise having been carefully dissected; the thorax was raised, and put into the posture for drawing. This subject had been a remarkably strong man; the parts large and well marked, the vessels particularly large and tortuous. It is the same subject from which I made the drawing of the cutaneous veins and nerves of the arm. This and the preceding Plate will be greatly illustrated by turning to the first Plate of the Second Volume, which gives a minute view of the anatomy of the axilla.

THE BONES.

- A, The STERNUM.
- B, The ENSIFORM, or XYPHOID cartilage.
- C C C C, The cartilages of the true ribs.
- D D D, The five false ribs.
- E, The CORACOID PROCESS of the scapula.
- G, The ACROMION PROCESS.
- H, The GLENOID CAVITY of the scapula.
- I, The intervertebral substance of the fourth lumbar vertebra, counting from below.

MUSCLES.

- K, The SUBCLAVIAN MUSCLE, reaching from the first rib to the clavicle.
- L, The PECTORALIS MINOR MUSCLE, arising from the third, fourth and fifth ribs, and inserted into the coracoid process of the scapula.
- M, The SERRATUS MAJOR ANTICUS, dissected from its origin from the ribs, and left hanging at its insertion into the basis of the scapula.





N, The fleshy part of the DIAPHRAGM, where it arises from the ribs of the right side. The lower surface of the diaphragm is not seen, the cartilages of the ribs intervening from the obliquity of the view.

O, That part which is called the LIGAMENTUM ARCUATUM. The ligamentous nature of this arch is not readily seen; it is a mingling of tendinous-like fibres of the diaphragm, of the transversalis abdominis, and quadratus lumborum muscles.

P P, The central and tendinous part of the diaphragm, consisting of an irregular mixture of tendinous fibres surrounding the opening for the transmission of the VENA CAVA.

Q Q, The LESSER MUSCLE of the DIAPHRAGM. It arises from the fore part of the body of the vertebrae by the sheath of tendons called CRURA DIAPHRAGMATICÆ. Strong columns or fasciculi of muscular fibres are seen to surround the aorta, to decussate, and again to separate, for the transmission of the œsophagus. This lesser muscle of the diaphragm expands or terminates in the central tendon which is marked P.

R, The hole for the PASSAGE of the INFERIOR CAVA.

S, The hole for the passage of the œsophagus.

T, The convexity of the diaphragm towards the thorax, seen through the intercostal spaces, the intercostal muscles being taken away. By thus opening the thorax, the diaphragm falls flaccid, that degree of suction or vacuum which existed before, and kept it tense, so as to form a full arch rising to a level with the rib, being destroyed.

ARTERIES.

1. The RIGHT CAROTID ARTERY, rising from the chest.

2. The LEFT CAROTID ARTERY.

3. The LEFT SUBCLAVIAN ARTERY, where it comes out from under the clavicle and subclavian muscle.

At this point the attempt is made to compress the artery in operations about the shoulder-joint and axilla.

4 4 4. The INTERNAL MAMMARY ARTERY, seen in its course behind the cartilages of the ribs.

5. A more considerable branch rising through the interstices to supply the superficial parts. Similar twigs are rising, as the artery proceeds downwards, to supply the pectoral muscle and the mamma in the female subject.

6. The THYROID ARTERY, rising from the subclavian artery.

7. The THORACICA ACROMIALIS.

8. The great THORACIC ARTERY, or external mammary artery, raised up. Its natural place and appearance is seen in the Plates of the arm.

9. The SUBSCAPULAR ARTERY.

10. A THIRD THORACIC ARTERY. The others are very irregular.

11. The ARTICULAR ARTERY, a branch of the subscapular.

12. The division of the subscapular artery.

13. The RIGHT PHRENIC ARTERY.

14. The LEFT PHRENIC ARTERY. These form circles and anastomoses with each other, and with the internal mammary, and with the branches of the emulgent arteries.

15. The COELIAC ARTERY giving off its three great branches to the spleen, the stomach, and the liver.

16. The SUPERIOR MESENTERIC ARTERY.

17. The RIGHT EMULGENT ARTERY. 18. The LEFT EMULGENT ARTERY.

From this drawing, or in the subject at this stage of the dissection, we see the conical shape of the whole thorax; each rib, as it is removed from the first, being the segment of a larger circle. We observe the extreme narrowness of the chest above, and that it is by the projection of the bones and muscles of the shoulder that the appearance of breadth is given to the chest. So wounds passing asslant the ribs, and through the pectoral muscles and the shoulder, or into the axilla, shall appear to have

penetrated the ribs; the probe, while passing under the scapula or pectoral muscles, may seem to be penetrating the chest.

The course of the internal mammary artery is apt to be forgotten by surgeons. It does not frequently disturb him in practice, yet it is an important artery. Like the intercostal arteries, it is exposed to injury from the fractures of the ribs or sternum; and being much larger, the consequences of such injuries are more dangerous. The bones are destroyed, and the heart oppressed by the pouring of its blood into the anterior mediastinum.

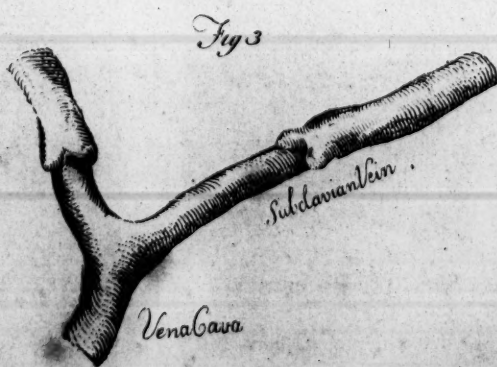
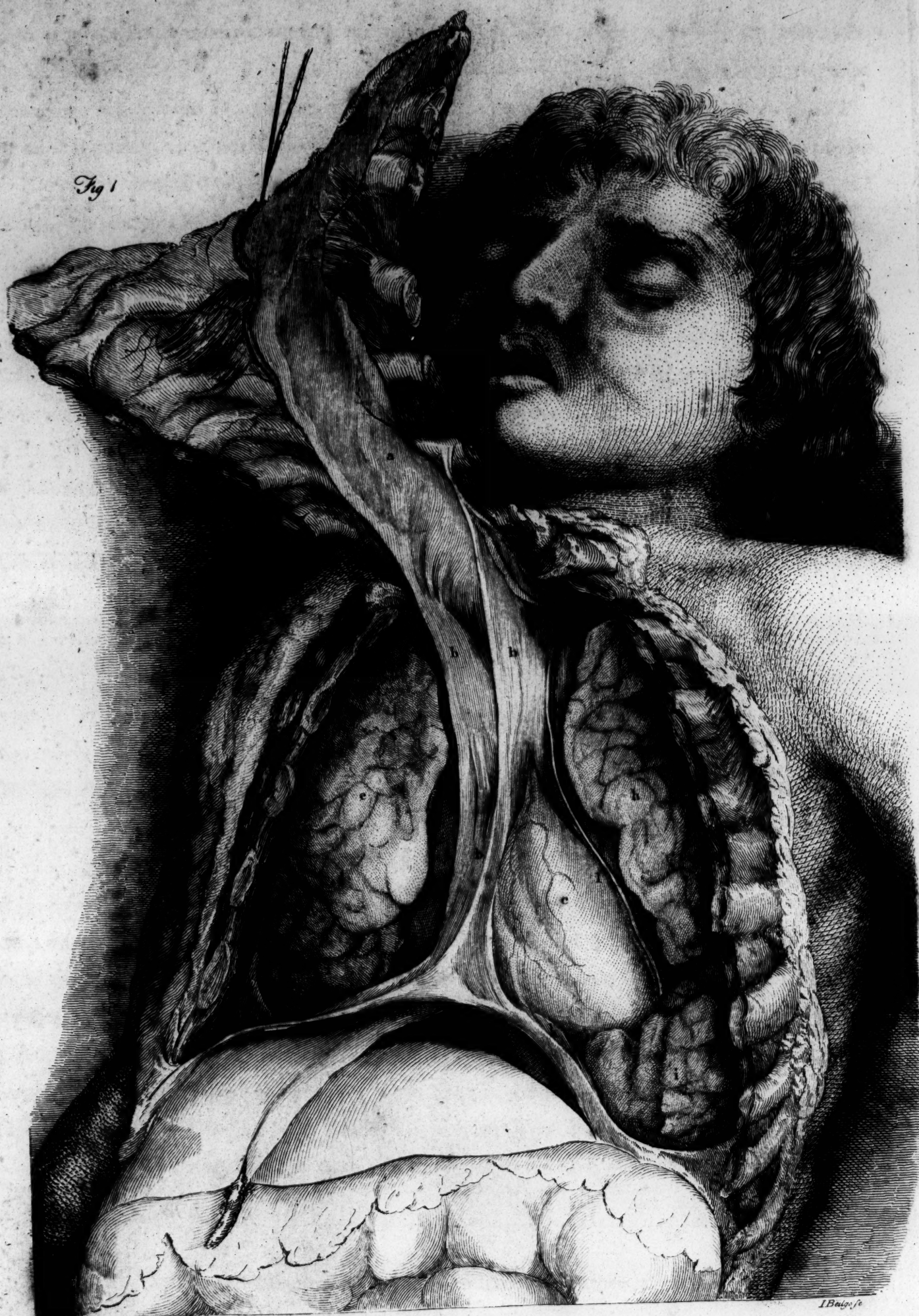
We see also from this Plate how peculiar the rising of the diaphragm is. In the middle part, at R, where the great vessels are passing, and where it is connected with the mediastinum, or middle partition of the breast, it is fixed; but upon the great lateral portions is its greatest latitude of action. From the rising of the diaphragm into the thorax at T T, we see what was already mentioned, how frequently wounds must penetrate both the breast and belly, passing into the breast, and wounding the lungs, then perforating the diaphragm, and wounding the stomach or liver. In empyema, when there has been of course previous inflammation, or in the more common suppuration of the lungs, the cavity of the chest being diminished, the diaphragm rises higher, and coming in contact with the ribs, adheres to them; so that if the operation for empyema were to be performed at the point of election, the surgeon would find himself in the abdomen. I have lately seen a case of injury of the breast from wrestling, where the fourth and fifth ribs had been broken; this was succeeded by a tedious illness, caries of the ribs, and extensive sinuses under the integuments and pectoral muscles. In this case, the propriety of making a free opening into the chest was suggested; but, upon dissection, it appeared that the inflammation and suppuration had extended to the lungs, to the pericardium and heart; even the lungs were wasted, and the diaphragm adhered closely to the ribs; so that the first incision would have penetrated to the liver.

The patient, who is at present in the hospital, gored with a bull, gives us another example of the necessity of attending to the boundaries of the breast and belly. We see, that in the concavity of the diaphragm, there is lodged the most important viscera of the belly, viz. the liver, stomach and spleen; so that the omentum and small intestines covering the stomach and colon, present at the margin of the ribs opposite to the eighth rib. Now, in this case, the bull's horn passing into the belly on the left side, and turning up, struck the margin of the ribs, tore them up, and hurt the lungs; but the elasticity of these parts made the point of the horn slip off, and it again tore the integuments of the abdomen. At one of these openings, the jejunum hung out; at the other a great part of the omentum, and on the second day there is emphysema from the laceration of the lungs.

THIRD DISSECTION OF THE THORAX.

Of Opening the Thorax,—and of the Connections of the Heart, Lungs, and Investing Membranes.

To open the breast, the integuments are to be cut through in the length of the sternum, and with the origin of the pectoral muscle are to be dissected back, until the joining of the cartilaginous and osseous part of the ribs is laid bare; which is observable by the difference of colour, the whiteness of the cartilage, and the livid or cineritious colour of the bony part of the rib. At this joining, the ribs, and the



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intercostal muscles, are to be cut through; and the joint of the sternum with the clavicle, being dislocated, and the lower part of the sternum separated from the diaphragm, it is to be lifted upwards (as in Plate VI. fig. 1. a), or entirely removed. But if there is to be afterwards an injection of the vessels in the breast, there will be a great destruction of small branches of arteries, and much trouble in tying the internal mammary and intercostal arteries: in this case, therefore, it is better to saw through the sternum at once, after the first incision, and violently to draw the divided sternum asunder; for by this the internal mammary arteries are preserved—a great ornament to a preparation of the chest—and no arteries of importance are cut. In private dissection, when the abdomen is to be opened, the incision may be continued down from the sternum to the pubis: for the integuments in all this length, from the clavicle to the pubis, will stretch sufficiently to lay open the viscera of the belly in this one longitudinal cut.

When the sternum is lifted, as in Plate VI. the anterior mediastinum (b b) is stretched betwixt the pericardium (c), which covers the heart, and the under surface of the sternum (a); and it must be cut before the sternum can be fully raised. On looking under the sternum, when raising it, the mediastinum may be seen stretched, and (as it is gradually torn from the lower surface of the sternum) separating into two layers (b b), and forming a triangular cavity (d).—This is more evident in young subjects. This cavity, when the sternum is let down again, is seen to close by the elasticity of the membrane. In children, the mediastinum, and all the membranes lining the chest, are more delicate and transparent; and when the sternum is thus raised, in this cavity, which is artificially produced betwixt the layers of the mediastinum, the lowermost part of the thymus is seen. With little dissection this gland may be displayed, stretching from the pericardium over the great vessels which come from the heart, and its root connected with the lower thyroid veins*.

When the sternum is laid back, the parts appear thus: The division of the thorax into two distinct cavities by the mediastinum (b b)—the lungs of each side (e f g h i) lying distinct from each other in these cavities—and betwixt them the heart, obscured by the pericardium (c); and the cellular membrane, which, before the sternum was raised, formed the anterior mediastinum, is scarcely to be distinguished upon the pericardium.—The mediastinum (b b), dividing the thorax, will in the subject be observed to run obliquely; for on the lower part of the sternum, and near the diaphragm, it does not adhere to the middle of the sternum, but is removed towards the left side, and is attached rather to the cartilaginous parts of the ribs than to the sternum. This makes the right cavity of the chest larger than the other; and the difference is further increased by the heart (c) included in the pericardium and protruding from the mediastinum still further into the left side.

The PLEURA is the membrane which lines both cavities of the chest; and as these cavities do not communicate, the pleura of each side is a distinct sac; and, by their coalescing in the middle, they form the mediastinum. This division of the thorax by the mediastinum keeps the lungs of one side independent of those of the other—and the action of the respiratory muscles will dilate the lungs of one side, although the cavity of the other side be laid open; and consequently the lungs of that side fall collapsed and inactive. The inner surface of the pleura, where it lines the ribs, is dense and smooth; but on the side attached to the ribs it gradually degenerates into the common cellular texture. Therefore, to divide the pleura into layers is not difficult: but still the one layer will appear the common cellular substance, or the periosteum of the ribs; while the other will be the smooth internal surface of the pleura.

If there be no preternatural adhesions of the lungs to the pleura where it lines the ribs, the general figure of the lungs is easily understood.—It will be seen, that the base of the lungs, or that part which rests upon the diaphragm, is concave, answering to the convexity of the diaphragm; that they reach far

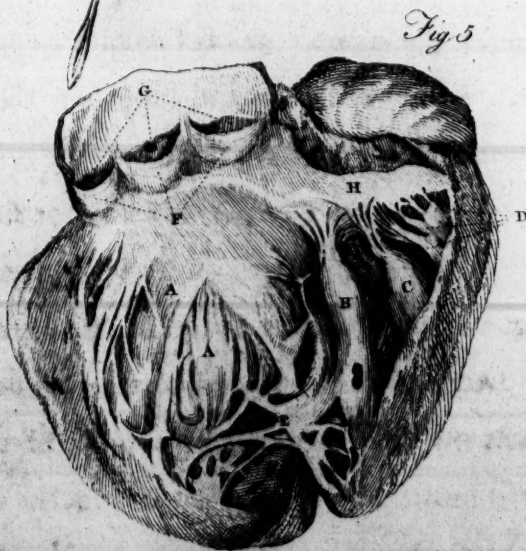
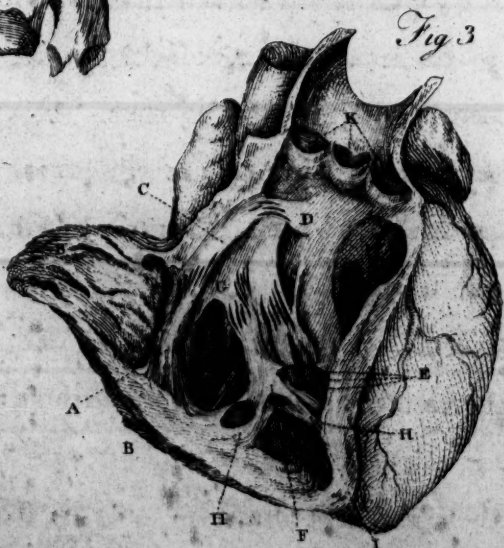
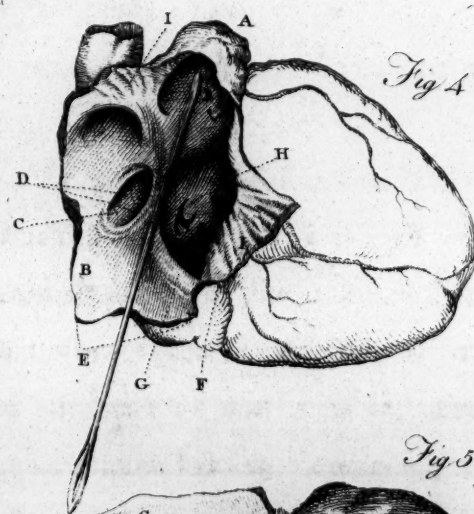
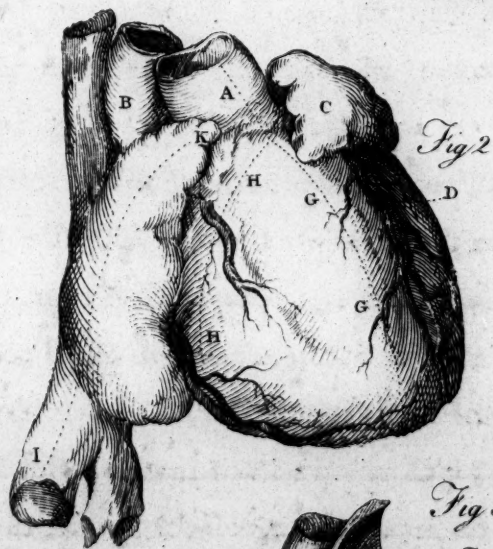
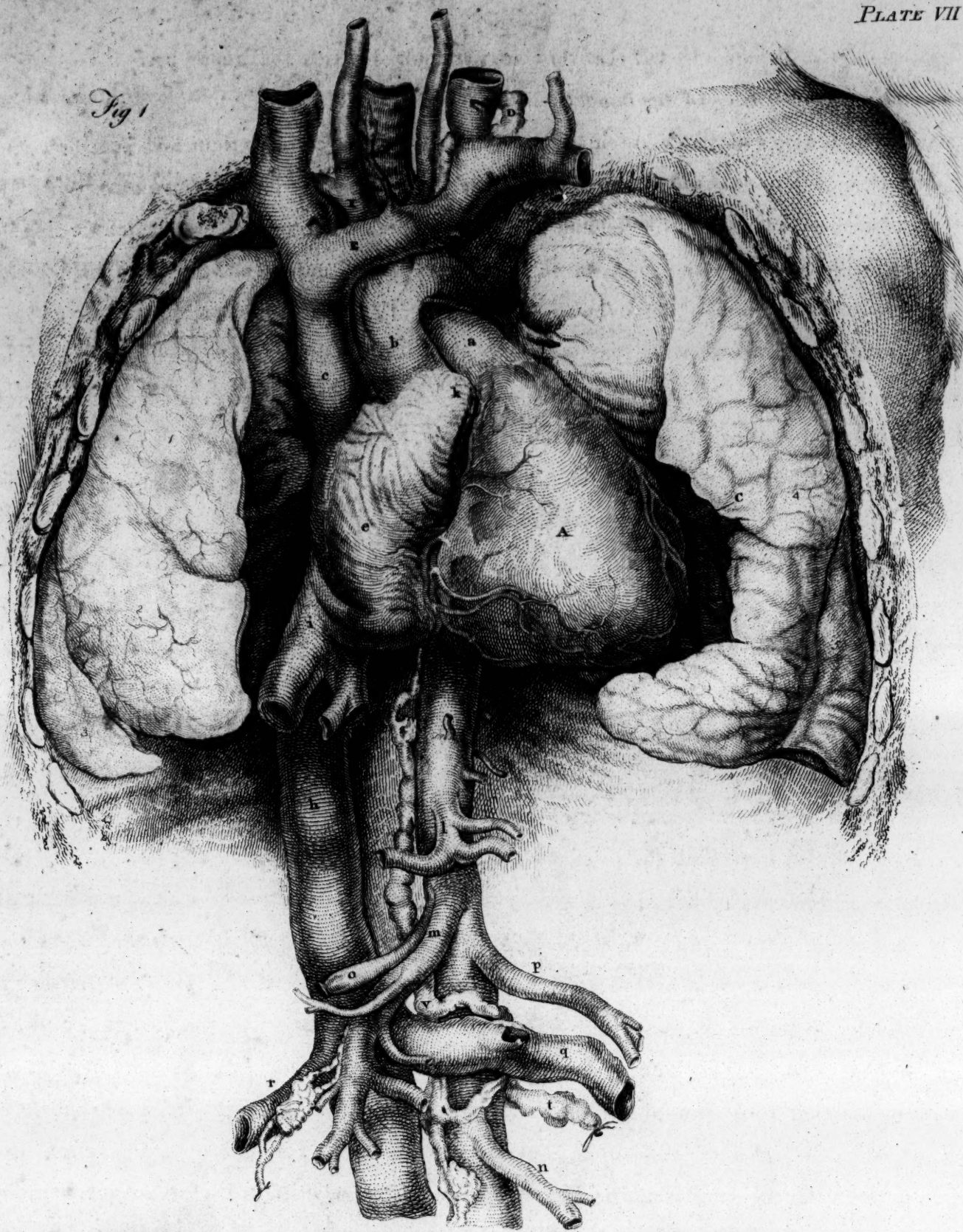
* It was once a favourite demonstration to dissect off the ribs and sternum, and leave the pleura entire, and to blow up the cellular interstice of the layers of the anterior mediastinum.

behind the diaphragm; and that they are pyramidal towards the upper part of the chest, answering to the pyramidal shape of the connected ribs.

The lungs of each side are subdivided into lobes. Those of the right side generally into three (e f g)—two greater ones, and an intermediate lesser lobe; and the left into two lobes (h i). This, however, is sometimes reversed. These lobes are again divided into groups of cells; and these again into a series of smaller vesicles, into which the air is admitted by the minute and less rigid branches of the trachea. Into the sulci, forming the divisions of the lungs into lobes, the delicate membrane investing the lungs is continued. These clefts in the lungs cannot surely be for allowing them easy motion, in adapting themselves to the form of the chest, or in embracing the heart with their prolonged points: For as there is no cavity in the chest before it is opened, and as the surface of the lungs is closely applied to the surrounding surfaces, there can be no room for motion in the sides of these clefts upon each other. On the contrary, they must keep as closely in contact as if they adhered: nor can one lobe retract whilst another swells up to fill its place, as in the intestines—the motion of the lungs not being caused by their own powers of contraction or dilatation, but by that mechanism which surrounds them, and which must apply equally to all the lobes at once. It is evident, that the pleura has the same relation to the lungs, and inner surface of the chest, that the peritoneum has to the intestines and inner surface of the abdominal muscles; the pleura costalis being reflected at their root to form the pleura pulmonalis; the pleura will be found finer, and more compact in its structure, than the peritoneum.

That the relative situation of all the parts, and the inflections of the pleura, may be correctly understood, they may be illustrated thus: In the middle of the breast lies the heart, with the great arteries and veins proceeding from it, and the trachea and œsophagus.—These all lying betwixt the sternum and spine, would form a division of the breast independently of the mediastinum. The lungs, again, lie upon each side, connected by their arteries and veins, and the branches of the trachea. Now, suppose two bladders, one on each side of the thorax, placed betwixt the lobes of the lungs and the ribs; suppose also that these were to swell till their sides infinuated into every interstice, and covered every projection; the sides of these cysts, having stretched over the surface of the lungs, would, if allowed to meet in the middle of the breast, form a partition, consisting of two layers of membranes. But where the heart and great vessels intervene, the cysts would not coalesce, but would contain them in their duplicature. Near the fore part, under the sternum, and before the heart, they would meet: and behind, again, near the spine, they would contain, betwixt their layers, the great vessels running down the fore part of the vertebra; and as they came off from the spine over these vessels, they would form a triangular space, surrounding the œsophagus, aorta, vena cava, and thoracic duct. Such, indeed, is the manner in which the anterior and posterior mediastinum are formed by the two layers of the pleura. Only it will be observed, that in nature there is no actual coalescence of the pleura of each side to form the mediastinum, as the intervening heart and vessels leave no interstice for this union; unless the anterior mediastinum (b b) shall be considered in this light. But, to proceed with the illustration, supposing these bladders to be infinuated betwixt the lungs, they would be stopped by the vessels which go to the lungs from the heart; and surrounding them, they would form the *LIGAMENTA PULMONUM*. To carry the similitude a little farther for the sake of illustration, let us suppose, that the outer surface of these sacs were to adhere, at one part, to the inside of the ribs, and, following the curve of the inside of the chest, to adhere also to the vessels going to the lungs, and to the lungs themselves, a lively idea of the real situation of the pleura may be obtained. For this membrane may actually be traced from the inside of the ribs over the vertebrae of the back, and from the vertebrae over the lungs, and then reflected from the root of the lungs to the mediastinum.

When the breast is opened, the lungs collapse, since they are kept distended only by that complete vacuum which is in the thorax. By collapsing, they lose their natural situation, and retire from the side





of the pericardium. The heart, covered with its pericardium (c), is seen protruding its apex towards the left side, and pushing the mediastinum, which covers the pericardium, before it. It is seated upon the diaphragm, to which (at k) the lower surface of the pericardium adheres, while the layer of the mediastinum is reflected off upon the diaphragm; and this layer can be dissected from the pericardium in the young subject.

In this first view, the phrenic nerve (l) will be seen descending to the diaphragm upon the side of the pericardium, and turning over the apex of the heart. The vessels which are seen upon the fore part of the pericardium belong to the ramus pericardio-diaphragmaticus of the mammary artery; and the larger branch which is seen accompanying the phrenic nerve is the ramus comes nervi diaphragmatici of the same mammary artery anastomosing with a branch of the right phrenic artery.

The PERICARDIUM is a strong white and compact membrane; smooth upon the inside towards the heart; never adhering to the heart but in disease; and moistened with a continual exudation. It supports the heart in its place, allows it free motion in its natural play, and restrains it in its inordinate actions. When we lay open the pericardium (by flitting it up on the fore part), and expose the heart, the right ventricle (Plate VII. fig. 1. A.) protrudes; the right auricle (e) is towards us; the left auricle is retired, and its tip is seen lapping round upon the left ventricle: from under this tip of the left auricle, a branch of the coronary vein and artery (d) proceeds down to the apex of the heart. The course of these vessels may serve as a mark of the division of the ventricles by the septum, by which the cavities of the heart may be laid open; for they run parallel to the division of the two ventricles by the septum, and a little to the left of that division. If this mark, or the natural division of the ventricles, be not sufficiently distinct upon the outside of the heart, by grasping the heart in the hand, the left ventricle will be found firm, fleshy, and resisting; whilst the right ventricle is loose, and feels as if wrapped round the other. But these marks, by which the heart is to be dissected, will be afterwards observed more particularly.

Following up the right ventricle to the root of the artery disemboguing from it, we find the artery (Plate VII. fig. 1. a) betwixt the two extremities of the auricles; then it seems to turn entirely round under the arch of the aorta (b); but it sends only the right pulmonic branch under the aorta, while the left (B) goes to the lungs of that side. The aorta (b), again, seems to rise from the middle of the base of the heart, and takes a turn forwards from the left ventricle, which lies in a manner behind it.

Even in the uninjected state of the heart, it can be observed how it is placed towards the left side of the chest, and how in its position, in regard to the ventricles, it is oblique too; as that ventricle which is called the right (A) is almost directly forward, whilst the left (C) is behind, and almost completely hid by the right ventricle. It may also be seen how both ventricles rest upon the diaphragm, making the lower surface flat, as if moulded by its own weight, and forming its obtuse and acute margins; its point or apex being turned forwards, and towards the left side, so as to strike its pulsation upon the joining of the cartilaginous and bony part of the fifth rib.

Holding the pericardium from the right auricle, the inferior cava (i) is seen coming up through the diaphragm, and the superior cava (c) coming down from the upper angle of the pericardium, and behind that part of the aorta which is within the pericardium. A probe can be introduced behind the superior cava; in which case, the probe will be insinuated betwixt it and the veins going from the right lung to the left auricle. Upon lifting the heart from its place, and pressing upon the back part of the pericardium, it astonishes us at first to find the back-bone projecting so far forwards, and resisting the finger. These marks are very useful in examining the parts in disease. It is useful to observe the situation of the heart in the breast; because, being held in the same position when it is taken out of the

body, the manner of laying it open can be simply described, and the description of its diseases easily understood.

In tracing the pericardium up to its connection with the great vessels, it is found to be reflected from those vessels over the whole heart, and to form the outer covering of the substance of the heart. But here it is more delicate, and of a totally different nature from the proper pericardium. When this membrane which covers the heart is considered as the pericardium continued and prolonged, we are obliged again to explain its situation, when entire, by the awkward supposition of a sac, emptied and laid upon the heart. In which case, the outward layer would represent the pericardium; and that which was in contact with the heart, the membrane of the heart itself. That the connections of the pericardium may be understood, it is only necessary to lay it open: but to demonstrate it more completely, a tube and stop-cock may be introduced by a small puncture, and the pericardium strongly blown up: then the layers of the mediastinum may be dissected a little off it, and the connections at the root of the great vessels shown, with its vessels, nerves, &c.

It may be observed, in regard to the pericardium, that the heart is never what we would call completely filled; that is to say, the ventricles and auricles are not distended at once; but the action of these alternating with one another, the pericardium, instead of being alternately distended and relaxed, must, in the regular actions of the heart, be much more stationary than we are at first aware of. So in injecting the heart, though the pericardium, being entire, may restrain the too great enlargement of the auricles or ventricles, yet it is no measure of the quantity of injection to be thrown in; and it can give no assurance of the heart being filled with its natural proportion of fluid; for either the quantity which belongs to two of the cavities of the heart may be divided among the four, or if all are filled to the utmost of their natural distention, the investing pericardium must be stretched beyond its due extent.

FOURTH DISSECTION.

Of Opening the Heart to Demonstrate its Internal Structure;—and of Dissecting the Coats of Arteries.

SUPPOSING the heart to be rudely cut away, with its vessels short, and to be held nearly in the position in which it lies while in the body, these marks may be observed:

First, The PULMONARY ARTERY (Plate VII. fig. 2. A.) is before the aorta (B); and these vessels are in a direction crossing each other. Secondly, Upon the left side of the pulmonary artery, the tip of the LEFT AURICLE (C) appears; and under it a vein and artery (D), descending to the apex of the heart. Thirdly, The RIGHT AURICLE lies behind, and towards the right side of the aorta: a principal vein and artery (F) are seen emerging from the fat at the base of the ventricle, and under the margin of the auricle; they likewise run down to the apex of the heart. If the great arteries have been cut close to the heart, the play of the semilunar valves may be observed by looking down into the vessels, and raising the valves by blowing into them with the blow-pipe.

OF OPENING THE RIGHT SIDE OF THE HEART.—To open the RIGHT VENTRICLE, an incision may be made from the root of the pulmonary artery (A) down to the apex of the heart, parallel with the right branch of the left coronary artery and its accompanying vein (D), which come out from under the left auricle, but a little to the right of those vessels (G G). By a cut made in this direction (care being taken to cut no deeper than the thin sides of this ventricle), none of the columnæ carneæ will be cut; for the ventricle will be opened exactly to one side of the septum of the heart: and being then enabled to see what parts are to be cut, the incision may be continued round the base of the heart, in the direction of the dotted line (H H), by the root of the pulmonic artery and margin of the right auricle: or the first incision (G G) may be continued round the point or apex of the heart, so as to lay it open as if it were cleft or split from the apex.

The action of the semilunar valves of the pulmonary artery being examined from below, that artery may be slit up, and the inside of the right ventricle be displayed, as in fig. 3.

OF THE PARTS SEEN UPON OPENING THE RIGHT VENTRICLE (Plate VII. fig. 3.).—First an irregular column of flesh (A) is seen rising from that part of the ventricle which is laid back, and dividing into eight delicate cordæ tendineæ; and these are again expanded into a broad tendon (C), which is the anterior division of the tricuspid valve. From a little mammillary process of flesh (D), near the valves of the pulmonic artery, and where the surface of the ventricle is smooth, there is sent out, in three divisions, a great number of delicate cordæ tendineæ; and which are also connected with this anterior division of the valve (C). The next division of the origins of the cordæ tendineæ is from the septum of the two ventricles; from which they arise by separate little pillars of flesh (E). And, again, from the backmost part of the ventricle there is a strong pillar of flesh (F), having a double origin from the two opposite sides of the ventricle, and to which the great posterior division of the membranous valve is attached. The transverse connections betwixt these muscular attachments of the valves should be observed. From these three divisions of this circle of membrane which surrounds the opening from the auricle into the ventricle, it is called the tricuspid valve. It must be considered rather as the ventricular valve of the right side than as the valve of the auricle; in the same way that the valve in the great artery is called the semilunar valve of the aorta.

The smoothness of the ventricle towards the opening into the pulmonic artery may be observed: and the pulmonic artery being slit up (as in fig. 3.), the three semilunar valves of this artery (K) will be seen. These valves are more frequently perforated in the edges than those of the aorta.

OF OPENING THE AURICLE.—A small part of the trunk of the vein should be left unopened; for when it is entirely slit up, it will not be always easy to distinguish the mouth of the vein, nor, consequently, the situation of the parts as relative to the course of the blood.

To lay open the right auricle, introduce a probe or blow-pipe into the lower cava (fig. 2. I), carrying its point to the projecting part of the auricle at (K), which lies contiguous to the root of the aorta. Using this as a directory, the auricle may be slit up in the direction of the dotted line (fig. 2. IK); by which the Eustachian valve, and every important part, will be avoided. Continuing to hold the heart nearly in the situation in which it lies while in the body, upon the flap (B, fig. 4.) which is laid toward the right side of the heart, the remains of the FORAMEN OVALE may be seen (C D) in the partition dividing the two auricles. This fossa ovalis is an irregular depression, of an oval form, with its border (especially upon its upper part) elevated into a ring. It may be distinguished by the difference of colour by which it is surrounded: its margin (D) is white, and has more the appearance of tendon. Within this there is a circle of those fleshy fibres which form the MUSCULI PECTENATI (I) of the auricle; and the membranous part in the middle, which performed the office of a valve in the

foetus, is white and more callous, and being sunk somewhat resembles the tonsils in the throat. This membranous part (marked C, fig. 4.) seems continuous with the margin upon the lower part, while, upon the upper part it goes behind the margin of the fossa: and here (exactly in the direction of the dotted line C, fig. 4.) it may be examined with the probe, if the valve be still open, which it frequently is in children.

If the lower cava, where it expands into the auricle, be held open, or if the vein (I, fig. 2.) be slit up with the auricle (as it is in fig. 4. E)—then, by extending the point (F) upon the left side of the vein, there will be seen a membrane stretching from the inner side of the margin of the foramen ovale, round upon that half of the root of the vein nearest to the opening of the auricle into the ventricle.—This is the EUSTACHIAN VALVE (G): it is like the duplicature of the inner membrane of the auricle.

Behind the Eustachian valve is the opening of the great coronary vein (H); which, running round the margin of the left auricle, gathers the smaller coronary veins. The little semilunar valve on the mouth of this vein was likewise first described by Eustachius.—Several mouths of small veins may be observed near it, and having all little pellucid valves covering their mouths.

When the auricle and ventricle of the right side are thus laid open, the play of the tricuspid valve may be observed by holding out the auricle, and allowing the ventricle gradually to sink in water, when the valves will rise, and close the opening into the ventricle.

OF OPENING THE LEFT SIDE OF THE HEART.—Introduce the blade of the scissors into one of the pulmonary veins, and insinuating it into the part of the auricle which projects by the sides of the pulmonary artery (fig. 2. C), slit it up. Little is to be observed in this auricle: the MUSCULI PECTENATI are not so strong nor so evident upon its inside as those of the right auricle. The PULMONIC VEINS open almost always in four mouths; those from the right lungs being closer together than the left branches.

To expose the left ventricle, make an incision as far towards the left side of the vein which runs down from the tip of the left auricle to the apex, as the incision made to lay open the right ventricle was to the right of these vessels. In opening this ventricle there is less fear of cutting upon the columnæ carneæ, or upon the septum; as the right ventricle, being open, the septum is seen, and we can cut immediately on the other side of it; while the columnæ are collected in the further side of the ventricle, round the opening of the auricle, and are not much exposed to the knife (See B C D, fig. 5). Continuing the upper part of the incision round under the projecting auricle, slit up the aorta to show its valves: in doing which, that branch of the left coronary artery which comes out under the margin of the left auricle (fig. 2. D) must be cut through. When this ventricle is laid open, that part which is towards the septum is very little rugged with the interlacements of the columnæ carneæ, especially towards the opening into the artery (A A). The fleshy columns (B C D), on the contrary, which are connected with the mitral valve (H) (that valve which prevents the retrograde motion of the blood into the left auricle), are thick and short, and confined in a corner of the ventricle; nor do they spread their roots so extensively as those of the right ventricle. Two larger masses of these muscular columns, by which the valves are connected with the sides of the ventricle, may be observed (B C). That which is before the other (B) may be cut from its root, and thrown back with the portion of the valve to which it is connected. In what respect this circle of valve resembles a mitre, it is difficult to discover; but perhaps the more absurd the names of parts in anatomy are, so much the better are they remembered.

The connections of these valves are so much alike in every essential circumstance to those of the right ventricle, that a description of the effect of the contraction of the muscular columns will apply equally well to both.

Turning our attention to the femilunar or sigmoid valves, we may observe, that in the child they are delicate and loofely floating membranes, variegated in part by a white opacity ; while their edges are at some places fo transparent, that there appears often to be real deficiencies of the valve near the edge, when there is none :—It however happens not unfrequently that fuch deficiencies really do exift. In the adult, thefe valves acquire greater firmnefs and ftrength, and are opaque. Behind each of the valves are feen the LESSER SINUSES OF THE AORTA (fig. 5. G).

The ufe of thofe cavities behind the valves has been often confidered, but not fatisfactorily explained : they feem to be intended to prevent the poffibility of the valve being forced againft the fides of the artery by the ejection of the blood from the ventricle. If no fuch provifion were made, the blood would, upon the reaction of the artery, have no power upon them to throw them down upon the ventricle. But by this finus or cavity behind each of the valves, they are held as if in the middle of the fream of the retrograde blood ; and in its firft movement backwards, they are forced together fo as to prevent the regurgitation of the blood into the ventricle. The mouths of the coronary arteries (I, fig. 5.) open behind the two valves which are upon that fide of the aorta, contiguous to the pulmonary artery.

It is difputed whether thefe femilunar valves affect the paffage of the blood into the coronary artery. But though the valves were thrown fo clofe upon the fides of the aorta as to clofe the mouths of the coronary arteries during the fyftol of the heart, ftill that quantity of blood, which is behind the valve upon its being thrown back, would as effectually be propelled into the coronary arteries as if no valve intervened.

See, below, Difeafes of the Heart.

OF THE ACTION OF THE TRICUSPID AND MITRAL VALVES ;—AND OF THE EFFECT OF THE CONNECTIONS OF THE COLUMNÆ CARNEÆ.

THE difputes and variety of opinions about the action of the tricufpid and mitral valves have arifen from the fuppoftion, that the columnæ carneæ were merely the attachments of the cordæ tendineæ to the flefh of the ventricles. And, upon this fuppoftion of their inactivity, the whole attention was beftowed upon the contraction of the ventricle, and the approaching or retiring of the apex of the heart from its bafe during its action. Nor does it feem ever to have been confidered what is the peculiar connection of the roots of the columnæ carneæ to the parietes of the ventricles, or what effect the dilatation of the cavities of the heart muft confequently have upon them.

But fince thofe connections of the membranous valves of the auricle are only in part tendinous, while much of their length is muscular (viz. the columnæ carneæ), it is natural to fuppose, that thofe muscular columns are fynchronous in their action with the fides of the heart itfelf, with which they are intimately blended. While the action of the auricle is dilating the ventricle, and the cavity of the ventricle is diftending in every direction, the cordæ tendineæ will be ftretched, and the attached muscular columns will be relaxed, while the heart itfelf is relaxing. And it may be obferved, that in whatever direction the ventricle is dilated (whether in its tranfverfe or longitudinal diameter), the connections of the little mufcles attached to the valves are fuch, that they muft be extended and relaxed.

Again, during the contraction of the ventricle, the columns of Lower contracting alfo (the muscular fibres of both having been excited by the diftention of the ventricle) as the apex of the heart approaches the bafe (or the opening of the auricle into the ventricle) to which the valve is attached, the cordæ tendineæ are fhortened by the contraction of their muscular attachments :—and by this means

the valves are restrained from being inverted, and the blood from escaping backwards into the auricle from the contracting ventricle.

This explanation of the action of the columnæ carneæ does not rest upon the presumption of the elongation of the heart in its axis; which is a disputed point.—For if the connection of these little muscular columns be attended to, it will appear, that their elongation and relaxation must take place during the filling of the heart with blood, in whatever direction the ventricle is dilated by the influx of blood. For instance, in the right ventricle, the larger pillars connected with the valves have their base rising from the three opposite sides of the heart; and the lesser columns run in a direction across the cavity of the heart,—or cross bridles may be observed, which, being fixed into the longitudinal columns, must elongate their fibres upon the dilatation of the ventricle in width. And it may be observed, that by the contraction of the fleshy roots of the chief columnæ (as at H H, fig. 3.) they have a greater combined effect upon the point (F), or pull it through a greater space, in a middle course directly in the axis of the heart, than if the column of muscle attached to the valve ran in a direct course from the valve (G) to the apex of the heart (I). And it will readily be conceived, that the relaxation of the muscular power in these decussating fibres of the columnæ carneæ, will allow an equal latitude to the lengthening of the cordæ tendineæ (inversely as their powers of contraction), when the heart is dilating by the influx of blood from the contracting auricle.

It will be at once understood, how very imperfectly experiments, by filling the dead heart with water, will illustrate the play of the valves in the living body.

OF THE DISSECTION OF THE COATS OF ARTERIES.

To prepare the coats of an artery neatly, it should be injected with coloured tallow, and its coats dissected and pinned out; or the dissected coats threaded with a strong bristle, to keep them separate.—It is then to be preserved in spirits. To show its inner surface, it may be opened, the injection picked from its cavity, and its sides held separate, as in Plate IX. fig. 5. and 6. Even where we have to examine diseases (as in aneurisms, in ossifications of the coats of the arteries of the extremities, in stumps after amputation, or in diseased lungs, &c.), a cautious injection will not injure the diseased appearances in the cavity of the vessels, while it has the advantage of enabling us more easily to trace the blood-vessels in dissection, and to examine more accurately their connections with nerves or diseased parts. And the whole artery, if filled with injection, preserves, when dissected out and prepared, an intelligible shape, as in Plate I. fig. 6.

For the manner of demonstrating the muscularity of arteries, I must refer to the Introduction, p. xii.

There are, strictly speaking, only four coats in an artery;—the outer cellular coat—the muscular coat—the inner cellular coat—and that coat which forms the inner surface of the artery. To dissect the more numerous divisions of the coats, as described by some authors, the chief dependence must be placed upon the outer cellular coat; for this coat may be separated into layers making up any number of coats, while the others are more distinct, with something like a natural division between them.

THE EXTERNAL CELLULAR OR VASCULAR COAT, (fig. v. 1.).—By this coat the artery is connected with the parts in which it lies imbedded. It is covered in the great cavities by the general investing membrane, as the pleura or peritoneum. The small arteries which ramify upon the larger trunks of arteries (the *vasa vasorum*) run chiefly in this external coat.—These arteries are not, in general, derived from the larger vessels on which they lie, but come from some of the surrounding smaller branches of

arteries. They are to the great arteries as the coronary arteries are to the heart.—They supply and nourish the coats of the arteries, while the column of blood in their cavities seems to have no reciprocal action with the sides of the great arteries. To prepare these subordinate vessels, they must be injected minutely (while they lie in situ) with size, or fine varnish injection, of a light colour, or of pure white. If after this minute injection a coarser and dark coloured injection be thrown into the trunks, the light coloured and fine injection will be pushed onward, while the coarse injection fills only the trunks; making thus a contrast between the large vessels and the ramifications of the vasa vasa upon its surface. The artery, when thus injected and prepared, may be dried and varnished, or preserved in spirits.

The outer cellular coat of an artery may be separated into many layers.—In fig. v. 1. 2. it is separated into two; on the other side into three layers (3). These layers are gradually, as they proceed inwards, changed in their nature from that of the general investing cellular membrane, and are at last incorporated into a more regular coat, which has been called the tendinous coat (fig. v. 2.). It may be useful to observe, that it is this coat, according to Haller, upon which depends the tortuous shape of arteries; and that when it is taken off, the artery loses its peculiar character. The great peculiarity of the external coat is that which has been hinted at, viz. that while its inner surface, contiguous to the muscular coat, is more accurately defined, its outer surface seems imperceptibly to degenerate into the nature of cellular substance. The common cellular substance, which surrounds the arteries loosely more or less through the whole body, forms sheaths, which, in the dissection of some parts, it is necessary to preserve. Of this kind is the sheath which surrounds the carotid artery, jugular vein, and eighth pair of nerves, in the neck. It is very necessary often to show the situation of vessels in regard to the bed of cellular substance and fat in which they lie. Indeed nothing is of more consequence to the surgeon; for if we are taught the anatomy of accurately dissected muscles only, and of injected vessels cleared from all confusion, we can scarcely hope to recognise an artery in an operation on the living body. In a demonstration, therefore, if the students have not seen the whole progress of the dissection, some part of the artery should be left in its native confusion.

THE CARTILAGINOUS, TENDINOUS, OR PROPER CELLULAR COAT, then, of an artery, is the inner layer of this first coat, which has now been considered in its greater latitude. It is certainly a more appropriated coat, but outwardly it is undefined. To the state of the secretions in these cellular coats, have been attributed all kind of diseases of the arteries. “ If the oil in the cells be too thin, or only lymph be contained, “ the muscular coat may be too much relaxed: If there be too small a quantity of the moistening liquor, the artery loses the flexibility necessary for its action; and if the morbid matter become acrid, it “ will destroy the muscular coat.” These are very unlike the words of a man who wrote with the knife in his hand; the effect of doctrines which did not become celebrated from the elegance of the theory, but by the laborious investigation of the supporters of that school. It shows us, that observation and good practical inferences will be received, even though clogged with a weak theory.

THE MUSCULAR COAT.—Having dissected these outer layers, the muscular coat (Plate IX. fig. v. 3.) appears. Its fibres run in circles round the artery; no fibres run in the length of the artery. The circular fibres of the muscular coat are imperfect.—On attempting to trace any single fibre, it will not be found to make a complete circle round the artery; but the circle is made up of segments of fibres irregularly combined, the extremities of which are intermixed, and seem lost among each other.

THE INNER CELLULAR COAT.—In dissecting a diseased artery, with concretions formed in its coats, the concretions are, upon lifting the muscular fibres, found situated in the INNER CELLULAR COAT; if indeed

it deserves the name of a coat, since it is rather a connecting medium betwixt the muscular and the innermost coat of all. This inner cellular coat is difficult to be demonstrated;—but by flitting up the artery, and tearing off its innermost coat (fig. v. 4.), the existence of this one may be shown; it appears also in the ossified state of the artery, when the concretions are seen under the muscular coat upon the outside, and adhering to the innermost coat upon the inside. In a recent and healthy vessel, there is great difficulty in dissecting or tearing off this inner coat, unless a degree of putrefaction have taken place.

FIFTH DISSECTION OF THE THORAX.

Of the Injection and Dissection of the Heart and adjacent Vessels.

OLD subjects should never be taken for the purpose of preparing any of the viscera: for the fat is in old age peculiarly accumulated about the viscera, both of the abdomen and of the thorax. Nor is the fat deposited here derived from the extremities; for although the limbs of old people seem, during life, shrivelled and lean, yet the oil contained in them makes them also useless for preparing:—although dried with the utmost care, they sweat out greasy matter, which mix with and dissolves the varnish; and they never make clean nor lasting preparations. If the heart, therefore, has much fat accumulated about it, there should be no hesitation in sacrificing it, as a preparation to the attainment of some other point of inquiry, as the examination of its internal structure, &c.

To make a good injection of the heart, it is necessary to have the coagula well washed from its cavities; to have it warm and moist; and to pay particular attention to the filling of the coronary vessels, upon which the beauty of the preparation much depends. The coronary veins, and even the arteries, may be injected separately, by introducing a long tube down the cava and aorta; or the fine injection may be thrown in in this manner; while they are filled with the coarse injection, at the same time that the cavities of the heart are injected. By this means the surface of the heart is beautiful, the minute ramifications of these vessels being filled with colours answering to the colour of the injection in the right and left sides of the heart. The right side of the heart will be most advantageously injected from the left jugular vein, or the injection may be made by any of the other large veins. From any of these the right auricle and ventricle, with the pulmonary artery and coronary vein, will be filled. The left side of the heart may be injected from the aorta below the diaphragm, or from the axillary or carotid arteries of either side. By this injection all the arteries of the breast will be injected; the coronary arteries; the left ventricle (by the wax breaking down the valves of the aorta);—and from the ventricle the wax will find its way into the left auricle, and into the pulmonary veins. If in filling the heart the injection, by flowing down upon the vessels in a full stream, should raise the valves, either in the aorta or in its passage into the auricle from the ventricle, the valves may, by kneading or irregularly compressing the heart, be moved from their hold, and the injection have access to the whole side of the heart: but to prevent the possibility of the valves of the aorta being shut by the injection, they may be lacerated by introducing a probe down the aorta; or a tube may be introduced into one of the pulmonary veins,—though this will be seldom necessary. The knowledge of the distribution of the vessels will teach us how careful we must be to tie all the lesser branches of the aorta and the veins previously to injection. In injecting the veins, the vena cava may be tied above the diaphragm, or it may be tied below the liver, by which the venæ cavæ hepaticæ will be filled.

The THORACIC DUCT may also be injected.—If sought for in the abdomen, it will be discovered at its dilated part (Plate VII. fig. 1. v.) at the root of the mesenteric vessels; or upon the left side of the aorta (at t), as one of its branches runs under the aorta; it is then seen going up under the diaphragm, along with the aorta, and upon its right side, close to the spine (s). In the thorax, it may be discovered running up betwixt the aorta and vena-cava-pari. If it lie collapsed and undistinguishable, it may be raised by blowing into some of the glands upon the root of the mesentery, or into those upon the course of the external iliac vessels, or even into those without Poupart's ligament in the groin. It must be injected with a different colour from the veins, that it may not be confounded, in the thorax and at the root of the neck, with the branches of the veins.

In injecting the heart when out of the body, the numerous branches of the subclavian arteries and veins, and the intercostal arteries coming off in the whole length of the aorta, must be tied. And to make sure that all vessels are tied, except those into which the tubes must be introduced, let the heart and lungs be laid in a flat basin, and covered with water; then, by blowing into the principal trunks, all the open mouths of arteries will be easily detected.

OF THE VESSELS TO BE TRACED IN THIS DISSECTION.

In the first place, the pericardium being dissected off, all is made clear for the dissection of the heart and great vessels:—Then the fat which obscures the coronary vessels is to be dissected away;—the great coronary vein is to be shown encircling the base of the heart, and emptying itself into the right auricle:—The right and left coronary arteries are also to be displayed; they need little dissection, but upon the base of the heart.

In dissecting betwixt the aorta and pulmonary artery, there may be observed a kind of ligament between them, which is the remains of the DUCTUS ARTERIOSUS. The branching of the pulmonic artery (Plate VII. fig. 1. a.) to the lungs of each side being dissected, and the right branch followed under the arch of the aorta, and the branches of this artery, and the pulmonic veins, displayed for some way ramifying in the lungs—we must proceed with the aorta (b), as it rises from the heart, where it is called the ascending aorta. In young subjects, the THYMUS must be attended to: it is to be lifted from the pericardium and great vessels, and folded over upon the neck. Its blood-vessels will be found coming out from the root of the internal mammary artery of each side, and attached to the thyroid or tracheal veins. Upon the top, or utmost convexity of the aorta, three important branches (x y z) are sent off towards the right side: the arteria innominata (marked x) quickly divides into the right subclavian and right carotid arteries; the middle branch (y) is the carotid of the left side; the other (z) is the subclavian artery of the same side.

But the SUPERIOR VENA CAVA (C), and the trunk (E), common to the jugular and subclavian veins of the left side, cross before these important arteries. The superior vena cava, shooting up from the right auricle, and having escaped from the pericardium, is joined upon its back part by the VENA AZYGOS. This vein coming forward in an arch from the spine, upon which it creeps to one side of the aorta, and before the intercostal arteries, it pours its blood, gathered from the back part of the chest, into the superior current of blood. The vena cava, having got a little higher than the arch of the aorta, stretches a great arm (the left subclavian vein) (E) across the top of the chest, and before the root of the arteries which go to the head and arms. This branch, dividing into the internal jugular and the subclavian

veins, receives the blood from the left side of the head and neck and from the left arm : and at the angle formed by the joining of the internal jugular and subclavian veins of this side, the THORACIC DUCT (D) empties itself into the circulating system.

OF THE LESSER VEINS.—The *VENA MAMMARIA INTERNA* of the right side comes off from the upper part of the superior vena cava, where it is about to divide. Upon the left side, it comes off from the subclavian vein, opposite to the cartilage of the first rib. The *DIAPHRAGMATICA SUPERIOR*, or *PERICARDIO-DIAPHRAGMATICA*, on the right side, joins the vena cava at its bifurcation ; on the left it joins the subclavian below the mamma. The *THYMICA*, on the right side, sometimes joins the vena cava ; sometimes the gutturalis or thyroid vein, or some neighbouring branch : on the left side it empties itself into the subclavian vein. The *RIGHT PERICARDIAC VEIN* enters the root of the right subclavian vein : on the left side it joins the subclavian vein, or the diaphragmatica, or the mamma interna. The *THYROID VEIN*, or *TRACHEALIS*, or *GUTTURALIS*, of the right side, is inserted into the bifurcation of the vena cava : on the left side, into the upper and back part of the left subclavian. The distribution of these veins is described in their names. It is for the most part very regular ; but their communications with the larger veins are very inconstant, and differ in each side as the great trunks are different. There is little use for a minute knowledge of these vessels, unless that we may be able to tie them in injections*.

OF THE LESSER ARTERIES.—The *SUBCLAVIAN ARTERY* is the great source of the numerous smaller arteries which ramify in the thorax, upon the mediastinum and pericardium, and upon the under surface of the sternum ; and of those also which seem to come out from the thorax to be distributed upon the root of the neck and shoulder.

1st, The *INTERNAL MAMMARY ARTERY* of the right side is the first branch which the subclavian artery of the right side gives off after parting with the carotid. It is seen running upon the inside of the cartilages of the ribs near the sternum : It supplies much of the contents of the thorax anteriorly ; and anastomoses with the epigastric branch of the femoral artery upon the abdominal muscles.—It gives off the *ARTERIE THYMICÆ*, it sends branches through the ribs to the muscles and integuments.

2^d, The *INFERIOR THYROID ARTERY* is the second branch of the subclavian artery, and is subdivided into these branches: The *RAMUS THYROIDEUS*—the *RAMUS TRANSVERSUS COLLI*—the *RAMUS THYROIDEÆ ASCENDENS*—the *TRANSVERSALIS SCAPULARIS*, which, however, is as commonly the third branch of the subclavian, under the name of *SUPRA SCAPULAR ARTERY*.

4^{thly}, The *VERTEBRAL ARTERY*, going from behind the subclavian artery, enters the vertebral hole of the sixth vertebra of the neck.

5^{thly}, The *CERVICALIS PROFUNDA*—and,

6^{thly}, The *CERVICALIS SUPERFICIALIS*.

These two last are, however, frequently supplied by the wide spreading branches of the thyroid artery : and indeed we must reckon ourselves very fortunate in dissection, when we can furnish branches for those numerous names.

7^{thly}, The *SUPERIOR INTERCOSTAL ARTERY*, with its accompanying vein, can scarcely be dissected while the contents of the chest are in their place, as it lies close to the joining of the upper ribs with the spine, and comes from the back part of the subclavian artery.

* As the right auricle of the heart lies upon the diaphragm, the inferior vena cava must be very short. If the *VENA AZYGOS* had emptied itself into the vena cava at this place, it must have climbed upon the diaphragm, and been affected by its alternate action, and must have joined the cava within the pericardium. It follows the general course of the veins of the thorax, which go to terminate in the branches of the superior vena cava, where there is more easy access to them.

All these arteries will be more accurately told in the dissections of the neck and arm; and plans will be given to facilitate the explanation.

In preparing for the dissection of these vessels, the reader may observe the general distribution of the nerves, and mark the points at which they are complicated with the arteries and veins, in the Second Part of Vol. II.; where the dissection and general course of these nerves are treated of, from the base of the skull through the neck, thorax and abdomen.

To continue the dissection of the aorta, as it lies upon the spine deep in the chest, the lungs, and even the heart, would need to be taken away, to have a full demonstration of its branches, which are but few and insignificant. But by folding back the lungs from one side of the chest, any thing important may be sufficiently observed. In tracing the aorta as it goes down upon the spine, the following are the chief branches: The BRONCHIAL arteries are sent off to the root of the lungs, three or four in number, for nourishing the proper substance of the lungs. The OESOPHAGEAL arteries are sent off in small twigs to the oesophagus, as the aorta passes parallel to it in the posterior mediastinum: And small arteries are seen coming off from the aorta, at regular intervals as it proceeds downwards; and running into the interstices of the ribs, they proceed along a groove in the lower edge of each rib.—These are the INTERCOSTAL arteries, and are accompanied by branches from the vena azygos.

EXPLANATION OF PLATE VI.

The sternum raised, and the viscera of the thorax, seen in their natural situation.—a a, The under surface of the sternum, from which the anterior mediastinum is torn in lifting it—b b, The mediastinum separating into two layers as it is torn from the sternum, and thus forming a kind of triangular cavity d.—c, The heart covered by the pericardium—e f g, The anterior middle and posterior lobes of the lungs of the right side—h i, The anterior and posterior lobes of the left side—k, The diaphragm pulled up from the liver (which is in outline) by the raising of the sternum—l, The phrenic nerve attached to the pericardium.

FIG. 2. Shows the shape of the valve of the jugular vein, and the dilatation of the vein above it.

FIG. 3.—The superior cava and subclavian vein, much contracted, in a child.

EXPLANATION OF PLATE VII.

In the first figure of this plate, the heart and lungs are seen in the same posture as in Plate VI. only the pericardium and diaphragm are taken away. The heart is seen inclined to the left side—The right ventricle A, is forward—The left C, is behind—The coronary artery and vein (d) mark their division—a, Is the pulmonic artery—b, The aorta—c, The superior cava—i, Marks the very short trunk of the vena cava, common to the vena cava hepatica and vena cava abdominalis h.—e, Is the right auricle.

The lungs need no references.—The subclavian vein of the left side is marked E, as it passes before the branches of the aorta—x, Is the right subclavian artery—y, the carotid of the left side—z, The subclavian artery of the left side. The aorta, turning round the pulmonary artery and trachea, gains the spine, and runs down upon its fore part. It is seen again as it is about to enter the abdomen; and here it gives off the phrenic arteries. The coeliac artery is marked l—The superior mesenteric artery m—The inferior mesenteric artery n—o, Is the emulgent artery of the right side—p, The emulgent artery of the left side—q r, The emulgent veins—s t v, The thoracic duct, which is seen here running up by the side of the aorta, and appears again at D, where it terminates in the angle betwixt the left jugular and subclavian veins.

Figure 2d, 3d, 4th, 5th, are explained in page 44. 45.

GENERAL VIEW OF THE ACTION OF THE VASCULAR SYSTEM, AND OF THE ACTION OF THE DIAPHRAGM AS AFFECTING THE HEART;—BEING INTRODUCTORY TO THE DISEASES OF THE HEART AND VESSELS.

THERE are a few leading points in the action of the vascular system, which being acknowledged and kept in view, will enable us to examine with advantage the morbid appearances in the heart and adjacent vessels; or their preternatural structure, as in monsters, or in the imperfect animals. And as the appearances which we have to expect in morbid dissection are perpetually varying, to proceed at once to a detail of those appearances, without settling the principles upon which our estimation of their importance is to be formed, must expose us to continual difficulties.

It is necessary to recollect the situation of the heart in relation to the surrounding parts, and to consider how its motions are regulated.

When the diaphragm, which divides the thorax from the abdomen, is pulled down, and the thorax is expanded, and the lungs consequently dilated, it is natural to inquire, What effect this expansion will have upon the heart, or at least upon the great veins and auricles? As they lie within the same cavity with the lungs, they also would be dilated, or their action in some measure affected, by the vacuum* thus formed in the thorax, were there not a particular mechanism to counteract it. By the connection of the mediastinum with the heart, by its reaching to the upper part of the thorax and surrounding the great vessels, and by its being stretched over the pericardium, or rather intimately connected with it, and forming its outer coat—it embraces the whole circulating powers in the thorax. By this means the heart is so situated, that the effects of that dilatation of the cavities, by which the lungs are dilated, is counteracted in its operation upon the heart and vessels:—for the mediastinum, being connected firmly with the diaphragm, the diaphragm contracts only upon its lateral parts, while its efforts upon the mediastinum must pull the membranes closer about the heart, in proportion to the increase of capacity of the thorax, and to the tendency which the heart would otherwise have, in consequence of that increase, to dilate. This may serve as some explanation of the heavings of the chest, when, by violent exercise, or in any other way, the blood is sent into the right side of the heart in increased quantity; for while an

* It will not be understood that I mean here a separation betwixt the lungs and the inside of the thorax and an actual vacuum, but simply the tendency which the dilatation of the thorax has to expand any cyst whose cavities can be filled from sources external to the thorax; as the lungs, by the atmospheric air drawn through the trachea.

increase of velocity in the circulation of the blood requires a proportional increase in the action of the lungs, the compression of the heart and vessels, when the diaphragm acts strongly upon the mediastinum and pericardium, makes us instinctively struggle to procure the necessary dilatation rather by the expansion of the ribs than by the action of the diaphragm. If the lungs are thus dilated by the expansion of the thorax, then the diaphragm does not need to be so violently contracted, and consequently the pericardium and mediastinum do not so strongly compress the heart, veins, and right sinus. An increase of the velocity of the blood in circulation must be accompanied with a proportional increased action in the lungs, because this increase of the quantity or velocity of the blood passing through the heart, is an increase of its stimulus, which must be accompanied with a proportional increase of the power of action or irritability; the source of which is in the lungs, and which, through the medium of the blood, is bestowed upon the heart. Were not the heart thus invigorated to greater action, an increased flow of blood through it would exhaust its powers, and a load of blood be forced into its cavities, which it would be unable to propel forward; as happens in experiments upon the lungs of animals when the artificial breathing is stopped*.

But to return, this mechanism in the thorax brings the great vessels in the breast more to a balance with those in the belly, and other parts of the body.

Upon examining the situation and connection of the superior and inferior cava, it is evident that they are not so large, in proportion to the arteries, as the veins in other parts of the body are; and that the blood must consequently pass through them with greater force or celerity, since the diameter of the veins, compared with that of the arteries, must be the measurement of the comparative force with which the blood passes through them. At the bottom of the jugular veins, and at the mouth of the axillary or subclavian veins†, we find valves placed, which defend them, as they enter the thorax, against the regurgitation of the blood from the chest into the upper extremities and head, when the contents of the chest may (in consequence of any irregular action peculiar to the respiratory organs, as coughing or sneezing) be under severer pressure than the veins in the extremities‡. That it is not to prevent the back stroke of the auricle that these veins are guarded by valves, we may presume; since there are no valves guarding the pulmonic veins from the action of the left auricle, and since there are no valves in the lower

* It is said, that the blood, as a local stimulus, could not produce that regularity which the heart has in health, nor that irregularity which we find in disease. But the blood affects the heart in two ways;—first, by stimulating it to exertion, in consequence of the mere distention of its cavities;—and, again, by bestowing upon it, in its circulation through the coronary vessels (as in every other part of the body), life and the principle of activity. For when blood unventilated, unimpregnated with new properties (or whatever action the lungs produce upon it), gets access to the coronary vessels, it more quickly dissipates the energy of the heart than if the heart were allowed to exhaust itself, deprived of all circulation. It is of consequence to observe the appearance of the blood circulating in the coronary vessels, in experiments upon the action of the heart in living animals. This is not a matter foreign to the present subject; it is impossible to account for the way in which the blood is found distributed in the system after death without considering it.

† In Plate VI. there are two etchings of the veins at this part. Fig. 2d shows the natural dilatation of the internal jugular vein above the valve. Are we to consider this dilatation in the great veins of the neck as a provision against congestion in the head from any irregularity in the circulation of the chest, and as admitting a kind of deposit here of that blood which would still more subject the head to the load of repelled blood during violent coughing, &c.? In violent fits of coughing, the contents of the breast are under violent compression during the convulsive expiration; but preparatory to that convulsive expiration, and after it, the mastoid muscle is in violent action as a muscle dilating the chest, the head being fixed, and must compress this dilated vein which lies immediately under it; and as the blood in the vein cannot enter the head again, it is forced into the superior cava. See further of the veins of the abdomen in this action, note §§, next page.

‡ In dissecting subjects in which there are enlargements of the heart, or where palpitations of the veins of the neck have formed a symptom of this disease, and where the pericardium is found dilated, &c.;—it is of consequence to examine the state of relaxation of the diaphragm, the valves of the veins in the neck, the valves in the heart, and the general relaxed state of the membranes in the thorax, as explaining the symptoms of the disease during life.

cava. This last circumstance suggests to us the probability, that in every irregular motion in the action of respiration, the compression upon the vessels is the same in the abdomen as in the thorax; for if there were a possibility of a greater compression in the thorax by any voluntary exertion of the body, or irregularity of respiration, the lower cava would have been defended likewise with valves. And it will appear, from a review of the action of the abdominal muscles and diaphragm, that the veins in the thorax and abdomen do in all actions suffer like degrees of compression. Let it be considered for a moment, what would be the consequence upon the viscera of the abdomen, if, during a fit of coughing, their vessels were liable to as violent distension as we sometimes see in those of the face. That the compression upon the vessels of the thorax, and upon those of the abdomen, is the same, will further appear from this consideration, that when the abdominal muscles act strongly, the diaphragm yields, which prevents the greater compression of the abdominal viscera. On the contrary, when the diaphragm reacts and resists, then the force resisting (viz. the diaphragm) being equal to the force first exerted by the action of the abdominal muscles, it follows, that the portion of the cava which is in the thorax is as strictly compressed by the mediastinum as the cava in the lower belly is by the abdominal muscles. Again, if the diaphragm acting should be supposed to compress the vessels round the heart, it must be remembered, that its contraction pulls strongly upon its origin, or insertion, only according the resistance which its action meets with: and as the mediastinum may almost be considered as the insertion of this muscle, if the abdominal muscles do not react, the mediastinum cannot be strongly compressed, and the abdominal muscles when they do react compress the lower cava with an equivalent force.

If the pressure were not equal in the breast and in the belly, but greater in the breast, then would the blood be occasionally repelled from the breast, and accumulated in the abdomen §§.

It comes next to be considered, What is the power which dilates the auricle; and what is the consequence of the action of the auricle upon the column of blood in the veins! The great use of the auricle is, to prevent the action of the ventricle upon the circle of blood contained in the vessels from propelling the blood round upon the ventricle, even whilst yet in its state of contraction. For when the ventricle contracts, it throws forward into the veins a quantity of blood besides what dilates the arteries; and a portion of the column of blood in the veins nearest the heart is consequently driven forward and fills the auricle*. That the dilatation of the arteries is not sufficient to account for the quantity of blood sent out by the contraction of the ventricle, is apparent from the flow of blood being continued in the veins during the contraction of the heart and dilatation of the arteries:—and that quantity of blood which is more than sufficient to dilate the arteries and continues to flow into the veins, would, it is evident, distend the sides of the veins, were not the auricle at this time relaxed so as to allow an easy exit from the veins of this addition to their column of blood. This free exit to the venal blood, in the direction of the axis of the veins, prevents an additional lateral pressure.

§§ In violent coughing, straining, sneezing, &c. wherever, in short, the thoracic and abdominal muscles are exerted, stagnation is said to be produced in the veins near the thorax. This, it may be observed, can never be brought directly to the test of experiment, unless in the veins of the neck; because these actions cannot be produced when the breast of an animal is laid open. The opinion has arisen from seeing people coughing violently with the face turgid with blood; but this is caused by the difference of compression in the thorax, and in the head and arms, and does not prove that there is any difference of compression in the belly and in the breast. And the greater turgidity of the face to that of the arms is probably occasioned, partly by the action of the muscles of the neck (chiefly by that of the *platysma myoides*, which covers the external jugular vein, and is in violent spasmodic-like contraction during violent coughing), and partly because any dilatation of the vessels of the head must be external only.

* In examining monsters, and in dissecting the more imperfect animals, the great principle which must keep the blood in an uninterrupted circulation ought to be remembered, viz. the alternate action and relaxation of the muscular fibres of the arteries; their elastic power being only subservient in resisting, and in throwing the contraction of one set of muscular fibres upon that which is to follow, that it may be dilated, and again in its turn react. An artery cannot circulate the blood either in a monster or a worm without some part of the circle alternating with it in action and relaxation.

It is perhaps more difficult to explain why there is not a regurgitation of the blood, or dilatation of the veins, upon the reaction of the auricle. For though the force and quantity of the blood sent from the ventricle be so much more than sufficient to keep the veins dilated to their stationary diameter as to dilate the auricle also, there is still to be accounted for that portion of the blood delivered by the ventricle, which was sufficient to fill the arteries, and which continues to be forced on during the contraction of the auricle.

The question comes simply to this, At what time, or by what power, does this quantity of blood, which is sent out by the ventricle, and which is more than sufficient to dilate the auricle, and stimulate it to contraction, return to the ventricle? Does the blood, even during the contraction of the auricle, still force itself onward by the effort of the arteries to contract, not in opposition to the contracting auricle, but acting, in aid of the auricle, to distend the relaxed ventricle? Or does the quantity of blood, which is by the contraction of the arteries propelled into the veins, distend the veins through the whole body during the contraction of the auricle, and when the blood may be stopped from entering the heart? The first of these seems to be the truth;—because, by supposing the contraction of the arteries still to carry forward the column of blood in the veins so as to flow through the auricle into the relaxing ventricle, the whole quantity of blood sent out from the ventricle is accounted for without any pause or stop in the whole circulation †. This seems to agree the best with our observations on living animals: and it accounts for the lateral pressure of blood upon the sides of the veins being at all times equal. And if the combined power of the arteries cannot force a portion of the column of blood, equal to their contraction, into the ventricle during the contraction of the auricle, then not only must it be allowed that the contraction of the auricle is stronger than that of the arteries, but that it is so even when its whole side is as if opened by the relaxation of the ventricle. It is evident, then, that the relaxed ventricle is the only opposition to the flow of the blood from the veins into the heart during the contraction of the auricle. Were we to account for the quantity of blood sent out by the ventricle, by supposing a dilatation of the veins to take place, we must allow a stoppage, or retrograde movement, in the great veins, which is contrary to the facts every day before us; and besides, this supposed dilatation of the veins (which may be imperceptible, being so small a quantity of blood diffused over the whole body), must be accompanied by a greater compression upon the blood of the veins at one time than at another; which should be easily observed.

But the consideration which puts this question of the action of the veins in its truest light, is this: The power of an artery is great in proportion to its length; and this increase of power, which the artery gains as it recedes from the heart, is thus exactly proportioned to the distance through which it has to propel the blood back by the veins. In this way all the veins (whether the coronary vein of the heart, or the cava of the body) pour their blood with an equal force into the auricle. An action of the veins, on the contrary, would not be thus counteracted; but the blood would flow to the heart with unequal force, according to the length of the vein which acted upon it.

It may be well to consider, how very small any dilatation of the veins, occasioned by such an insufficient cause as is generally assigned, must be; and the investigation will at the same time take away from

† From observations on the heart's motions in living animals, when influenced by artificial breathing, Mr. Hunter concludes, "That the auricles are only reservoirs, capable of holding a much larger quantity than is necessary for filling the ventricles at one time, in order that the ventricles may always have blood ready to fill them." This is the opinion which is carelessly adopted in all books in which any explanation is given of this. But it is perfectly clear, that since there is a quantity of blood sent out from the ventricles sufficient to dilate the arteries as well as the auricle, there must, upon the relaxation of the ventricle and action of the auricle, be a quantity of blood equal to that which dilated the vessels returned into the ventricle, besides what is supplied by the auricle; and the contraction of the auricle cannot from its own stores sufficiently dilate the ventricle, without there being in the next round of actions a deficiency of blood sent by the auricle into the ventricle.

the support which might be derived to the above opinion from the observations of those who have seen even violent pulsation in the veins, and conceived it to be occasioned by the action of the ventricle, and to be synchronous with the pulsation of the arteries *. The pulsation in the arteries is occasioned by the whole quantity of blood sent through them, in the direction of their axis, lengthening them, in opposition to their elasticity, and causing them to form contortions or curves. This is well illustrated in the pulsation of the heart; which is in fact the pulsation of the aorta, not of the heart, and is caused by the effort of the aorta to lengthen itself, and to form a more direct line, carrying the heart as on its point. It is illustrated also by the contortions of the arteries of living animals; as in the membranes of the chick in ovo, by the pulsating bud of an artery when tied in our operations:—and it gains additional proof from considering the very small dilatation which an artery must suffer in any one point touched by the finger, though the dilatation of the whole taken together is considerable. It is not, therefore, the degree of dilatation, which we feel in the pulse, but the shock given to the column of blood by the action of the ventricle. Before adopting the opinion, then, that the reaction of the arteries should perceptibly dilate the veins, or convey a pulsation to them, it must be remembered, that the veins, either during the contraction of the heart, or during that of the arteries, do not receive the impulse of the same quantity of blood which gives the pulsation to the arteries; but if they should be supposed to dilate during the contraction of the arteries, they receive only that which is spent in the dilatation of the arteries; and if they are supposed to be dilated during the contraction of the heart, then are they dilated by the blood sent from the ventricle, which remains after the dilatation both of the arteries and auricle. To all this must be added the very great difference of capacity of the veins and arteries;—we must consider that many veins of a greater size accompany a single artery in the extremities; and how immense the capacity of the veins is in many parts of the body; as the sinuses of the head, the great veins in the neck, abdomen, and pelvis. How little effect that quantity of blood which dilates an artery (in a degree imperceptible to the sight) should have, when thus dispersed in the greater capacity of those veins, which is triple, or even quadruple that of their accompanying arteries, must be at once acknowledged.

But further, a pulsation, supposed to be transmitted to the veins, would differ from that given to the arteries, in this—The pulsation of the arteries is great near the heart, because their elastic resistance is great, and the force of the current of blood sent forth from the heart is propelled violently in a narrow channel: and the elastic resistance of those greater arteries throws the force of the blood forwards unexpended into the smaller arteries, which have a less degree of resisting elasticity, and a diameter (the caliber of their branches being taken collectively) infinitely greater than the trunks:—and as those branches have, as they recede from the heart, an additional muscular force in proportion to the loss of their elastic resistance, which muscular power is then in a state of relaxation, that portion of the blood which is expended upon the dilatation of the arteries, is bestowed upon their extremities chiefly; and the extreme arteries again react by their muscular power, in exact proportion to their degree of dilatation—and thus they become the most active agents in the circulation. But if the great arteries near the heart were di-

* Mr. Hunter says, "I think I have seen the difference of the projection so great, that it hardly could arise from that cause alone;" viz. the lateral dilatation of the accompanying arteries.—And he adds, "The large veins near the heart have a pulsation, which arises from the contraction of the heart preventing the entrance of the blood at that time, and producing a stagnation. This I saw in a dog," &c. The inconsistency of this is evident. He finds a dilatation of the veins synchronous with the dilatation of the arteries, viz. by the contraction of the ventricle: and, again, when they should unload themselves of this blood which dilates them, they are precluded by the action of the heart preventing the entrance of the blood, and forming a stagnation. And in opposition to both these observations, he says in the same page, that in some fevers the arteries contract, and the veins dilate alternately. Having an unsettled wavering opinion, he makes observations in direct contradiction. All observations in experiments upon the dilatation of the vena cava near the heart, the effect of artificial breathing on the action of the heart, and stagnation of the blood by expiration, are inaccurate;—for by the opening of the breast the whole actions in the thorax must be completely deranged.

latable in a great degree, it would retard the circulation; because the force of the ventricle would be expended upon their dilatation where there was no need for it, since the dilatation is a provision for an additional muscular power, to be exerted in accelerating the motion of the blood. We see, then, that the arteries dilate as they proceed; that they form a cone with its apex in the heart; that the blood must move more slowly onward in the extremities; and that it loses in a proportional degree its impulse from the heart. The effect of the contraction of the arteries, then, upon the veins, differs from that of the heart upon the arteries, in this, that the effort of the heart is accumulated to a point, and the whole blood of the body is propelled through a narrow channel; that the contraction of the extremities of the arteries, on the other hand, although great when taken in its combined effect, yet being diffused over the whole body, and the action upon the veins being through their innumerable extremities, and the quantity of blood returned by the veins, during the impulse of the heart, not being equal to that which passes through the aorta, the blood in its passage through the veins cannot have the same effect in causing a pulsation with the current of blood through the aorta.

Those who conceive that there is a pulsation in the veins, and who argue from what they have observed of the beating of the veins, or the leaping of the blood from them when punctured, as from an artery, besides overlooking the effect of the alternate action of the heart and arteries (see p. 28.), do not seem to have considered what effect this great degree of action in the veins of the whole body would have, upon their insertion into the right side of the heart: for perceptibly to dilate the veins, would take a quantity of blood greater than is sufficient to dilate the auricle; while, by their account, this pulsation is occasioned by the same power which causes the pulsation of the arteries, viz. the ventricle. Now this is the same with saying, that the contraction of the right ventricle of the heart dilates the arteries, dilates the veins, and fills the auricle; and in this state the quantity of blood delivered from the heart is left, without accounting for the manner in which an equal quantity of blood with that which fills the arteries and veins returns to the ventricle from which it was propelled. When are the veins supposed in this case to be emptied? It must be during the contraction, not only of the auricle when the exit of the blood is more difficult, or, as the greatest supporters of this opinion say, is absolutely stopped; but also during the contraction of the arteries upon the other extremity of the veins, which probably produces a greater effect upon them than even the action of the heart, which is more remote.

The most essential difference between the veins and arteries consists in the different velocity of their blood. The quantity of blood under the active influence of the heart and arteries, at the same moment, is amazingly small, compared with that in the veins: but in any length of time, the quantity passing through the arteries will be equal to that passing through the veins; for the veins have the blood slowly moving in their large cavities, while in the arteries it is sent quickly through their narrow channels. The blood in the veins approaching the heart, is received as into a vortex, pushed in an instant through the right side of the heart, driven through the circulation of the lungs, has its properties invigorated, and in an instant is sent through the whole body, comes in contact with the parts upon which it is to act, is again deposited in the veins, where for a time it lies inactive, or sluggishly moving through their dilated cavities. If it were not for this distribution, and if the heart and arteries could not draw supplies from the more inert mass of blood in the veins, our lives would be still more liable to every accident, and a trifling loss of blood would be fatal. It may be of importance to consider, as connected with the animal economy, from what proceeds, or to what tends, the increased quantity of blood in the dilated veins of old people, and whether it corresponds with the diminished velocity of the pulse, &c.

From the nature of the subject, this account may appear prolix or confused. In the apparent simplicity of the heart's motions, there must be many actions in unison with each other, while yet in description it is difficult to convey an idea of the accuracy with which every action is adapted to that which

is to follow. But it may be useful, in concluding this subject, to give a short recapitulation of the mutual action of the heart and blood-vessels.

The contraction of the ventricle delivers into the artery a mass of blood, which quickly pervades the rigid trunks, and is sent into the more pliant muscular extremities, which are then in relaxation. These arteries dilate through their whole length, but chiefly in their small branches. Besides the quantity of blood dilating those arteries, there is enough sent from the ventricle of the heart to continue the propulsion of the blood into the veins, which, displacing a proportional quantity from those veins which lie near the heart, propels it into the auricle, and dilates it. By this means the auricle is dilating during the contraction of the ventricle: again, upon the relaxation of the ventricle from its action, the flow of blood is continued into the veins by another power, viz. the contraction of the arteries. By this contraction, the quantity of blood sent out by the last pulsation, more than was sufficient to fill the auricle, is continued forward with great force; a force as great as that exerted by the auricle: it consequently enters the relaxed ventricle along with that blood which is sent in by the contracting auricle; and so a mass of blood, equal to that sent out by the last pulsation of the heart, is sent again into the ventricle. The flow of the blood through the inosculating branches of the arteries and veins (which must be considered as the ultimate intention of the circulation) is flow and uniform, allowing a reciprocal action betwixt the fluids and solids; and is yet sent to the heart in such a manner, that the alternate action of the muscular power, the efficient cause of the circulation, is at one time allowed relaxation, and is at another stimulated to action.

See peculiarities in the Vessels of the Extremities, in the next Part, containing the Dissections of the Thigh, &c.

OF THE APPEARANCES OF DISEASE IN THE CIRCULATING SYSTEM.

Although, during life, the heart seems the most frequent seat of disease, the most distressing symptoms, and all the feelings of misery and oppression, seeming to be concentrated there; yet organic diseases, or such derangement of the natural structure as comes under examination in the dead body, are far from being common. This is to be ascribed to the more lively sensibility of the heart, and its strict dependence upon the reciprocal actions of the whole system: so that while the feeling of disease in the heart is common almost to a necessity in every more universal disease, its organic derangements are comparatively few.

OF THE APPEARANCE OF DISEASE IN THE COATS OF BLOOD-VESSELS.

Both arteries and veins are liable to have concretions formed in their coats; but in the veins it is an uncommon disease, and, apparently, the concretions are different in every respect from those found in the coats of arteries. Concretions in the arteries have been long a subject of inquiry; and it is one which indeed involves much matter of practical importance in its discussion.

The INNER CELLULAR COAT is generally the seat of disease in the arteries. It is the seat of ossifications, or more properly concretions. Steatomatous tumours, also, I have observed originating in the cellular substance, behind the inner coat of the aorta, and partially filling up the artery. The aorta has been totally obliterated, and the circulation carried on by the inosculation of the thoracic and epigastric arte-

ries, by the inosculations betwixt the phrenic, and coeliac, and mesenteric arteries. Before we can conceive, that the minute branches of these extended arteries could perform the circulation of the blood through the pelvis, and thighs, and legs, we must recollect, how slowly such obstruction approaches, and how unlike the instantaneous obstruction in the tying of arteries.

Pus is described by some authors as found in this internal cellular membrane; but it is more probable, that it was that kind of matter which surrounds the concretions.

OF CONCRETIONS.—Pushed on by the success of some experiments upon the generation of bone, I applied with keenness to every opportunity of examining morbid concretions in the coats of arteries; and although I came to no new conclusions with regard to their formation, I was confirmed in the opinion that, in accounting for dilatations in arteries, too much importance has been given to concretions, while the general state of the artery has been overlooked; and that concretions are more of the nature of an accompanying evil; and only one of many forms which diseased arteries assume. These concretions are situated betwixt the inner membranes of arteries and their muscular coat. They are of two kinds. More generally, they appear upon the inside of the artery, yellow and irregularly concreted tubercles; and upon the injection and drying of the artery, they raise its surface into irregularities, as in Plate IX. fig. I. It is in this state, that, upon opening them, they are frequently found surrounded with matter, thick, and of the same colour with the concretions. This led Haller to the explanation, that these ossifications, as they are commonly called, are concreted from a fluid matter deposited; in opposition to the opinion, that the matter is formed in the surrounding coats by the irritation of this foreign substance causing ulceration. Were this fluid matter produced by ulceration, we could not conceive that the artery should be able to sustain the force of the blood for an instant, or what limits should be set to the ulceration. These opacities are often seen without any concretion.

This matter surrounding the concretions was observed by the older anatomists; but was considered rather as a circumstance confirming them in their opinion of the concretions being true bone; for this they considered as the marrow.

In the broad scales, which more resemble bone, this fluid matter is seldom found. Such broad scales are frequently found almost completely surrounding the artery (as in Plate IX. fig. VII. and V.), without any dilatation or aneurismal enlargement of the artery; while the more irregular tubercles are common in the enlarged arteries, as in fig. I.

Rupture, from the scales formed in the coats of arteries, happens very seldom in the great arteries of the trunk. From the cases on record, it would appear, that the fair rupture of the aorta takes place more frequently within the pericardium, and at the root of the heart.

It is wonderful that the larger trunks of arteries, where they lie in an even course, are sometimes surrounded with scales of these concretions, while yet they seem to perform their functions. In fig. III. we have an example of a scale taken from the bifurcation of the aorta; which, from having been allowed to dry, appears here more intimately blended with the coats of the vessel than it really was. Ossifications in the lower part of the aorta are very frequent without dilatation. In fig. V. 4. many very broad scales are seen in the femoral artery, without any dilatation; and also in fig. VII. which is a remarkable ossification of the splenic artery. These instances would alone teach us how passive the great trunks of arteries are, compared with the extreme branches.

OF THE CAUSE OF ANEURISMS.—In aneurisms of the great arteries, the coats are found thickened, firm, and easily separating into layers, almost constantly with concretions formed in them, and with their elasticity always remarkably diminished. These ossifications have been always assigned as the cause of enlargements of the arteries; but the degree of the enlargement, and its place in the artery, do not seem

affected by the ossifications. If these ossifications caused the enlargement of the artery, by acting mechanically by attrition and destruction of its coats, they would produce, not a gradual and extensive enlargement, but a partial and sudden one; such as we find in the extremities. It has been said, that the ossifications in the coats of arteries occasion greater resistance to the dilatation caused by the action of the ventricle of the heart; and that this resistance exciting the heart to greater action, it becomes at last so great as forcibly to dilate the artery.—A strange subtilty, to make the strength of the artery the cause of its being overpowered. It is said again, that these ossifications destroy the muscular coat of the artery; and, consequently, rendering it incapable of withstanding the stroke of the heart, it ceases to second the stroke of the heart, and suffers itself to be dilated. But the muscular coat of an artery is not that which resists the passage of the blood, or rather the dilatation occasioned by the force of the ventricle; the muscular coat is alternate in its action with the heart. During the contraction of the heart it is in relaxation; and it is only when the heart intermits its action that the muscularity of the greater arteries acts in resistance to the muscularity of the extremities; whose combined power would repel the blood back to the trunks, and dilate them, were the greater trunks not enabled to resist by the additional action of their muscular power. The great power of resistance in the arteries near the heart to the blood propelled from the ventricle, is their elasticity. This is a power which yields, yet resists. By its yielding, and yet its uniform increasing resistance even to the utmost stretch of its elasticity, it subdues that shock which the great vessels would otherwise receive from the sudden exertion of the heart. Upon dissecting the coats of dilated arteries, it is apparent, that the whole functions of the vessel must be impaired; the coats are thickened; are easily divisible; and have lost their elasticity. And upon examining the length of the aorta, when thus diseased, it is found dilated; not uniformly where the ossifications are most numerous or longest, but often where there are no hardenings or concretions in the coats. On the other hand, whole tracts of ossification will be found without any dilatation of the artery. In this state, the arteries can no longer dilate upon the action of the heart, and uniformly resist and contract again; but, on the contrary, there is a more solid and inert resistance to the impulse of the heart, their coats being thick and unelastic: so that every contraction of the heart gains a point in the dilatation of the artery, which (unlike the dilatation of elasticity), is never regained. Thus, although the artery be actually strong in its coats, and dilated and filled with firm coagula of blood, yet will the impulse of the heart gradually encroach upon this inert resistance.

CAUSE OF DILATATIONS BEING MORE FREQUENT IN THE CURVATURES OF ARTERIES.—The arteries are more generally dilated at their curvatures, or where branches are sent off. The reason of this is evident, if we allow the above explanation of the cause of dilatation in general. Those who have paid minute attention to the structure of arteries, have found, that where an artery sends off a branch, or takes a sudden turn, its coats are strengthened to resist the action of the blood, which must be greater at these points: and as this increase of strength must consist in a more powerful elastic and pliant resistance to the current of blood propelled by the heart, combined with such a proportion of muscular power as to react equally with the rest of the canal; so when the coats of the artery become diseased, they bring the artery to the state of a rigid tube; and, consequently, the force of the heart becomes more quickly perceptible at those points which are most exposed to the current of the blood, and where that power which formerly resisted in a greater degree is now reduced to the same state of inactivity with the rest of the tube. Thus we find dilatations more frequent in the curvature of the aorta, at the root of the great vessels going to the head and arms; and in the belly, at the coeliac, and emulgent, and mesenteric arteries.

OF ANEURISMS IN THE EXTREMITIES.—This explanation of the cause of dilatation may be extended to the aneurisms of the arteries in the extremities; where we almost constantly find the enlargement of the

artery at the part where it lies in the great joints, as in the groin or ham. But in the aneurisms of the extremities there is often another cause of dilatation, which arises from the mechanical effect of the concretions in the coats. In dissecting the tumor of the artery, it is frequently found, not to be a uniform dilatation of the coats of the vessel, but the artery is seen upon one side of the tumor*, and resembles that aneurism which is formed by the puncture of the vessel, and by the blood escaping from it into the surrounding soft parts, and forming a sac. Wherever I have had an opportunity of examining the artery, it was much ossified and diseased above the tumor; a circumstance always to be dreaded in attempting the operation when it is an aneurism of the dilated coats.

These concretions in the coats form gradually; and they adapt themselves to the shape of the artery in the prevailing posture of the limb. If the leg be for the most part stiff and rigidly extended, upon any violent exertion the artery is bent, and its coats torn upon the edges of these concretions. On the other hand, if the limb be shrunk up and contracted, the artery being at the same time diseased in much of its extent, may have formed a scaly concretion in a curve answering to the bend of the artery at the joint, as in the ham or groin; and in this case a violent attempt to stretch the leg will have the same effect, since it must bring the artery to an angle differing from that of the scale which has been formed in its coats, and so rupture it. There are cases of this kind upon record.

MORE PARTICULARLY OF THE GREAT ANEURISMS IN THE BREAST.—While slight dilatations are very frequent in the aorta, as it proceeds from the heart, and in its great arch, it is universally observed, that dilatation of the pulmonic artery is very rare. When the dilatation of the aorta has proceeded a certain length, it rapidly increases. The drawing of the aorta which is given in Plate IX. fig. I. may be considered as the first stage of its dilatation, and is a common appearance. It seldom happens that the artery is in this condition near the heart, without being in some degree enlarged through the whole length of the aorta. Aneurism never is in its commencement a local disease. But when the dilatation of the artery has proceeded thus far, it generally at some one point gives way more easily; so that the dilated sides of the artery are pushed towards the root of the neck, or being forced directly forward in the chest, come in contact with the sternum. The bone for some time interrupts its progress: but by the continued impulse from the heart, the coats of the artery seem to be worn away in the pulsation against the bone; while, on the other hand, the periosteum and membranes which cover the bone are entirely destroyed, and the bone itself becomes carious. Or sometimes the dilated sac of the artery, stretching widely under the sternum, finds a less resisting passage betwixt the cartilages of the ribs, destroys their membranes, and, protruding, raises a beating tumor externally upon the breast. When this happens, there are generally two tumors; the tumor of the one side appears before that of the other, and commonly they rise upon each side of the sternum, about a hand's-breadth below the clavicle.

To examine the state of the parts, we may proceed thus: Dissecting off the integuments from the breast in the usual way, they may be laid back until the tumors on each side of the sternum are completely laid bare. But it may happen, that when the dilatation has proceeded freely in this direction, the skin (if it have not actually burst) is stretched and inflamed, and has become as it were one substance with the sides of the cyst, and cannot therefore be dissected off. When the integuments are still loose, upon taking them off, the pectoral muscle is found with its fibres thinly scattered over the protruding sac, and strengthening it; and the sac itself appears to be composed of condensed cellular membrane, with something like the natural coats of the artery forming its inner layer.

If it be intended to make a preparation of the diseased parts, the sternum being loosened from its attachments, the heart may be taken out along with it, and afterwards displayed with the dilated ar-

* See Plate XVI.

tery pushing through the interstices of the ribs. It, however, seldom happens that we can be thus far masters of our time in private dissection. When the sternum is raised in the common way, the tumor of the aorta is found adhering with a broad circumference to the under side of the sternum: this must be cut through, and with the coats of the aorta we must cut much hard coagula of blood.

Upon examining the under side of the sternum, the bony part of the sternum will in general be found wasted by the blood. Sometimes the cartilages, also, are found wasted; but they seem better to resist the blood. The blood must affect the bones by insulating them, and depriving them of the membranes which nourish them, and also by mechanical action. Upon examining the aneurismal sac, it will be found greatly thickened, irregular, with white callous scales or tubercles embued with a matter resembling pus; and upon the inside of the sac lamellated clots, partly resembling membranes, partly concreted blood. Upon turning the attention to the heart, it will, I think, be found small and firm in its texture, and forced lower down in the breast. Upon looking down into the dilated aorta, the valves appear thickened and white with concretions.

In thus describing the manner of examining these aneurisms of the great arteries, the most common circumstances attending them have been detailed; yet a great variety of appearances must present themselves to us. The coats which fill up the great bag of the tumor should be examined, so as to acquire some idea of their progressive formation; for this may perhaps explain some of the symptoms during the patient's life, as the sudden subsiding of the tumor, its more suppressed pulsation, &c. Or the tumor of the artery may be found compressing the trachea or lungs, or encroaching upon the cava, or in some more immediate way affecting the respiration or the circulation of the blood.

OF THE VEINS.—Dilatations in the veins near the heart never happen but as a consequence of the dilatation of the right side of the heart with blood; and in that case it is not a permanent increase of size in the veins, but a dilatation from the occasional fulness, caused by the difficulty of circulation in the heart:—it is strictly connected with the diseases of the heart, and they cannot be considered separately.—

A remarkable diminution of size in the veins near the heart is more common. In Plate VI. there is given a slight etching of the veins of a child at this place, where they were not larger than the veins of the arm. I had no opportunity of observing the effect of this during the patient's life: but the size or fulness of the heart seemed in no way affected by it.

There are instances of the great veins being quite impervious; a fibrous polypus-like matter, or hard fleshy substance, or a fatty medullary-like substance, filling up their cavities. And that they were impervious during life was confirmed in these instances, from the smaller veins being dilated to carry the blood; in one case, the spermatic vein in the belly; and in another instance, the vena azygos in the breast, performed the office of the cava. There have been found in the lesser veins (in those of the pelvis, and parts of generation, it would appear, more frequently) little stony concretions, round, and sometimes moveable. Ruptures, too, of the great veins are said to have happened; but this is a very rare disease. I have seen however a tumor seated upon the abdominal cava, which seemed to have destroyed the coats of the vein; for a spongy tumor projected into its cavity, and the blood seemed to have exuded into the tumor which covered all the roots of the celiac, upper and lower mesenteric arteries. The peculiarities in the veins of the extremities come afterwards to be considered.

DISEASED APPEARANCES UPON OPENING THE PERICARDIUM.

Upon opening the breast, there is always more or less water found in the pericardium. When the quantity is considerable, it is commonly accompanied with general dropsy or hydrothorax: the colour of the fluid takes a tinge from the blood, in the same way as macerating the heart in water would colour the water, though the cavities of the heart were tied up.

The pericardium is supposed to have a greater proportion of water, because it has a greater degree of action; but the additional explanation of Mr. John Hunter, viz. that it may also fill up the interstices betwixt the rounded surfaces, though ingenious as applied to the pericardium, does not mark a difference betwixt other cavities and the pericardium. Even the smaller collections of water in the pericardium are frequently accompanied with similar collections of water in the other cavities of the breast, and even in the belly; but water, if contained in the pericardium, is at once observed; while the smaller quantities of water in the cavity of the breast sink behind the lungs, and are not distinguished. Extravasations of water into the pericardium are common in all lingering diseases, where the strength of the system is completely exhausted. It probably is thrown out in the last feeble efforts of life. It is observed, that however much water there may be contained in the pericardium, still, upon dissection, this membrane is not found distended, but appears rather loose about the heart. This may happen from a deficiency of blood at this time in the heart, while in the living body the heart, during its utmost distention, may have been closely embraced by the pericardium.

In the pericardium there are often found spots of extravasation, the effect probably of recent inflammation. Sometimes the inflammation is more generally diffused over its surface; or we find adhesions formed at different points betwixt the heart and pericardium; and it happens also, though rarely, that the adhesions are complete in all the extent, uniting the pericardium with the whole surface of the heart.

Exudation of coagulable lymph is frequent within the pericardium. The lymph thus thrown out being by inflammation connected with both surfaces (with the heart and with the inside of the pericardium), is found drawn curiously into fibres; or perhaps taking a firmer hold upon the heart, and forming no communication with the pericardium, it is found adhering to the heart with an irregular and spongy surface towards the pericardium.

The pericardium is liable to a more permanent disease. It becomes thick, so as to be easily separated into layers like the coats of arteries, though in a lesser degree. And although we should not suppose such membranous surfaces as the pericardium liable to such a disease, it has been found studded over with white scirrhous tumors containing pus.

Matter, too, is found upon the surface of the heart; for it is subject to ulceration. I have seen it irregular and foul with disease upon the surface, and covered with a viscid matter; so that it seemed wonderful that the patient could have existed for a moment. In such a case as this, we may naturally expect to find the lungs adhering to the outside of the pericardium, and the pericardium again to the heart.

I have seen a fracture of the ribs, from extensive sinuses with caries, affect the lungs, communicate disease to the pericardium, and the pericardium thickened, containing much matter within it, and a small opening communicated from the sac of the pericardium and the extensive abscess in the lungs. The substance of the heart too was diseased, the outer membrane greatly thickened, and a greenish, thick, and adhesive matter upon its surface; yet here, in the last days of the man's illness, there was no peculiar symptoms, nothing differing from a common hectic fever.

When the blood is found extravasated into the pericardium, it would appear that it is sometimes difficult to distinguish the rupture from whence the blood came; whether it was from the root of the aorta, from the erosion of the ventricles, or from the coronary veins or arteries. And in all ruptures it will be

frequently necessary, after carefully examining the coats, to wash the heart out with warm water, and to syringe it gently into the great vessels, observing carefully from whence it escapes. When blood is extravasated into the pericardium, it does not support the action of the heart by its resistance to dilatation; but, on the contrary, the more that the pericardium resists, the more it must encumber the action of the heart: and when at last the disease proves fatal it is by the extravasated blood suppressing the action of the heart; for in proportion as the action of the heart is great in propelling the blood betwixt the heart and pericardium, so must the compression of that blood be in resisting the future dilatation of the heart.

OF THE APPEARANCES OF THE HEART AS ALTERED BY DISEASE.—There are no two appearances so common, and so much connected, as a bloated, soft, and watery state of the body, and a soft, flabby, and enlarged heart—where the heart seems in sympathy with the languid and dissolved state of the body. Such a state of the heart may be expected when the complexion has been of a pale and leaden colour, with languor of all the bodily functions, and a gradual loss of strength; the pulse becoming weak and small, accompanied with frequent faintings, and sense of weight and oppression at the heart. The consequence of a disordered state of the functions of the lungs upon the heart, and the loss of that reciprocal connection which is kept up during health, must often give rise to symptoms which are ascribed indiscriminately to the heart. When the breathing is gradually stopped in experiments with artificial breathing upon living animals, the heart becomes languid in its actions, and swells up with blood, which it is unable to propel. The blood undergoes its changes in the lungs imperfectly, and in this state is received into the circulation, and is sent into intimate union with the whole body. The effect of this contaminated blood is immediately perceptible upon the heart,—not that it is less capable of irritating the heart to action, but that it is incapable of bestowing the principle of action upon it, through the medium of its circulation in the coronary vessels. Then the irritability of the heart is destroyed, the blood is pushed into the heart by those powers which are not so immediately affected by the loss of the most essential properties of the blood, and the auricles and ventricles are overpowered with blood. This is an experiment which we must consider as imperfect, but it may lead us by analogy to the explanation of nearly the same phenomena in disease. When the powers of the system fail, when the action that must take place betwixt the fluids and solids is in any way interrupted, then is the delicate sensibility of every organ to its peculiar stimulus and action diminished. And when such an effect as this is produced upon the heart, (and it must take place in the last stages of many debilitating and tedious diseases), then does this state of the heart almost infallibly present itself upon dissection; the heart is enlarged, stuffed with blood, and flaccid in its texture, the aqua pericardii is in considerable quantity—and often the whole body is tabid. In this case, where the distention of the heart is habitual, the aorta is found remarkably small, being allowed gradually to contract its diameter, to suit the weak contractions of the heart; but still the artery is not (as we should expect from this explanation) thick, as if its coats had contracted, but remarkably thin and delicate. Nor must we suppose, that the state of the artery is in contrast with that of the heart—the heart being diseased, while the artery is in a state of healthy contraction; for the artery suffers the same loss of power with the heart. The difference is, that much blood is sent in upon the heart, which it is unable to push forward, and its sides are thin and dilated, while in the arteries there is a deficiency of blood.—Were it possible to conceive, that the heart should regain its healthy powers while the artery remained in this state, the artery would be too weak for the powers of the heart. It must be remembered, that though the muscular power of the artery is weakened, yet a permanent dilatation will not be produced whilst its elasticity remains:—for the arteries in their contraction have not to combat with the heart, but with the veins; therefore the arteries will not be permanently dilated by the contraction of the heart, unless when, as in their diseased state in aneurism, they are incapable of contracting again: And whilst the

contractibility of the arteries remains greater than that of the veins, they will not be seen dilated in the dead body.

We find uniformly, that when the heart is distended with blood, the right side of the heart is the most distended. This may be explained from the consideration of the difference betwixt the two circulations. The circulation through the body is the most extensive; and having greater power, must, upon the ceasing of the heart's motion, continue for a little to pour the blood into the right auricle and ventricle, while the left side of the heart has neither the same quantity of blood in the circulation of the pulmonary vessels, nor are these vessels so extensive, nor do they possess so great an elasticity, as the aortic system, and the extended veins of the body. Neither will the thick and strong sides of the left cavities of the heart allow of distention so easily as the right. The blood in the great vessels of the body is forced in upon the right side of the heart, when, from failure of its powers, it is incapable of propelling it into the lungs, and consequently into the left side of the heart.

In considering palpitations of the heart, we must remember, that the natural pulsation of the heart against the ribs is not the dilatation or contraction of the heart itself, but the effect of its contraction upon the arch of the aorta, as explained by Dr. Hunter. But in violent palpitations of the heart, where it is enlarged, and weakened in its powers, and the aorta is small and insignificant, the palpitations have been sometimes observed not to be synchronous with the pulse at the wrist, as the natural pulsation of the heart. In such cases, it may perhaps be the auricle which is affected with irregular motions when it is violently distended with blood; and the ventricles likewise being enlarged, the apex of the heart is forced against the ribs.

Palpitations or pulsations of the veins in the neck, and even of those in the arms, sometimes accompany enlargement and disease of the heart. To form a just conception of the cause of this pulsation, we must consider the peculiarities in the situation of the vessels near the heart (see p. 54, 55). The pericardium, investing the ventricle and auricle, suffers little dilatation by the action of the heart:—its greatest dilatation is during the diastole of the ventricles; because the space filled by the dilated ventricles is somewhat greater than that of the dilated auricles; yet the difference must be very small. The mediastinum involving the pericardium sends its membranes round the great veins which reach upwards from the auricle, and strengthens them. When, therefore, the veins in the thorax are dilated, and the whole heart enlarged, there must be a distention of these membranes likewise; and the disease is not confined strictly to the vascular system here, but even the diaphragm and involving membranes will be found relaxed, and the cavities dropical. By the dilatation of the veins the action of their valves is affected; they become too small for the diameter of the vessel, and the blood passes them. But the auricular valves, or those properly belonging to the ventricles, are not affected by the dilatation of the veins; their relaxation must depend upon the elongation of their muscular attachments to the inside of the ventricle. To cause a pulsation to be felt in the veins without the thorax, a loss of power, both in the valves of the veins and in the valves of the heart, must have taken place:—because, if the conclusion, page 59, be right, though the valves of the veins at the lower part should have lost their power, yet while the extended circulating powers return the blood with due vigour to the heart, the contraction of the auricle will not be felt retrograde upon the column of blood in the veins: But if the heart and veins be dilated, and the tricuspid valve have lost its action, so as to allow the blood to recede again from the ventricle into the auricle during the contraction of the ventricle (the contraction of the latter being greater than the first), the pulsation will be obscurely felt in the veins of the neck, beating synchronous with the arteries through the body.

In examining these diseases of the heart, therefore, in dissection, or in considering the symptoms during life, much is left to be decided upon by reasoning from the symptoms. It may be required to decide, Whether this pulsation be communicated to the enlarged veins by contiguous arteries—or by a

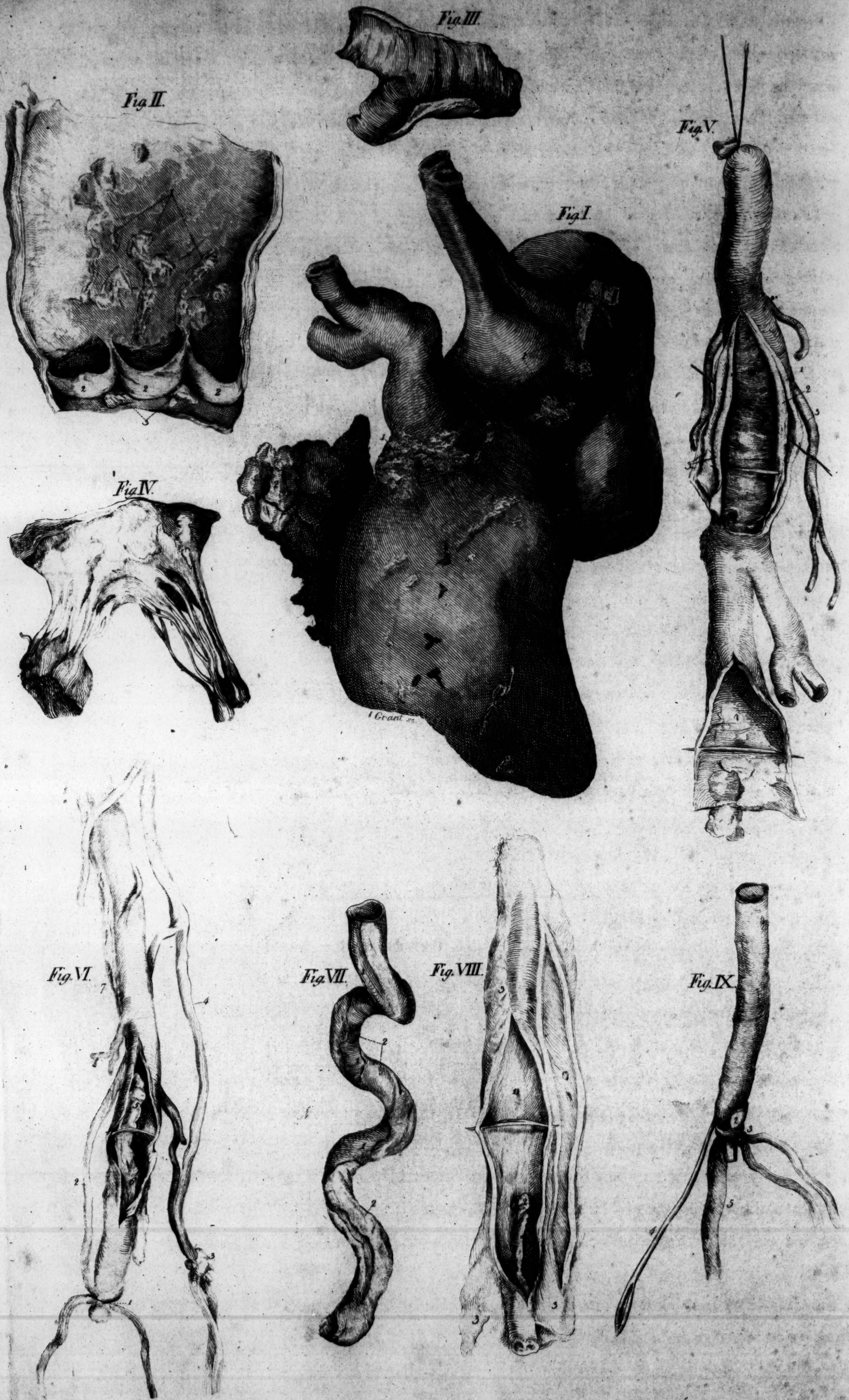
pulsation from the auricle—or whether it be communicated from the ventricle, through the auricle and the column of blood in the veins? or whether, again, the tremulous trilling feeling in the veins may not be produced by the action of both auricle and ventricle? In these diseases, the pulse is so irregular, and quick, and feeble, that it will be difficult to say whether the beating of the veins is simultaneous with that of the arteries (and consequently of the ventricle). In dissection, again, we have to examine the dilated state of the veins near the heart, and the state of their valves; the degree of relaxation over the whole membranes of the chest; the state of the auricle; the relaxation of the ventricles, of the columnæ carneæ, and of the valves of the heart.

Dilatations of the cavities of the heart are improperly called aneurisms: but there have been cases which seem to have truly deserved the name, where the ventricles of the heart have at a point been dilated into a pouch filled with coagulated blood.

OF DISEASED APPEARANCES OBSERVABLE UPON OPENING THE HEART.—To examine the diseases in the cavities of the heart, it is evident, that it must be dissected with as much care as for the demonstration of its simple anatomy (See page 44.). There is one circumstance, however, which may be remembered, that it may be required to examine coagula or polypi of the heart, which may reach from the ventricles into the great vessels, the aorta, or the pulmonary artery. To demonstrate these through their whole course, the cavities of the heart may either be laid open while the heart is in the body, or the great arteries slit up, and the coagula withdrawn from them, and kept attached to the heart. And in this case, the coagula being strong and minutely ramifying through the lungs or aorta, form a beautiful demonstration, when the cavities of the heart are opened, and their roots shown attached to the irregular inside of the ventricle, and the intricate interlacements of the cordæ tendineæ. That these polypi formed from the blood are for the most part formed after death, there can be little doubt; but still there are circumstances to be attended to which have induced many to believe that they are formed during life. They are found in layers, which argues a successive formation; or they are attached to the sides of the arteries where their coats are diseased; and their attachment does not appear to be accidental or owing to the simple coagulation of the blood. In many instances, however, where these coagula are remarkably firm, and such as we should suppose were formed during life, we find, upon examination, that the extremity, which is loose, lies in a direction contrary to the course of the blood; a direction in which we must be sensible it could not have remained during life; for it must have been driven in the direction of the current of blood, while the root was held nearer the heart. There must be coagula formed in dilated arteries; and to distinguish betwixt those which have been formed during life, and impacted in layers filling the dilated bag, and those which have been formed after death, is often impossible. How, then, in the case of the coagula prolonged into the great vessels (which alone are called polypi), can we expect to distinguish what has been formed in the last feeble actions of the heart, from those which have been formed after death? Were they ever formed in the vigour of the system, we should have had cases of some smaller part being torn from the trunk or stem of the polypus by the force of the circulation, and driven into some of the branches of arteries, so as effectually to interrupt the circulation of some important part.

Upon the whole, in examining coagula in the heart and great blood-vessels, it may be observed, whether they have been formed at once, and are of a uniform consistence; or whether they are of different layers, and apparently formed one upon the other at different times, and during life; whether, when they are attached, they have their loose extremities reverse to the current of circulation; or whether they have coagulated so slowly that the red globules are deposited or fallen from the upper part of the coat.





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OF THE VALVES AS SUBJECT TO DISEASE.—The muscular coat of the aorta is not continuous with the muscular fibres of the heart; probably because their actions are alternate: but the inner coats of the arteries are continuous with the lining membrane of the heart, and the membranous valves in the heart: the whole inner membrane of the heart, and even the tendons of the tricuspid and mitral valves, are evidently subject to the same disease with the arteries. We see them partly of their natural colour, partly variegated with a more opaque whiteness, and increased in thickness.

THE SEMILUNAR VALVES of the aorta and pulmonary artery will be frequently found thickened and more opaque than usual.—They are found ossified, too, or with a deposition of earthy matter. Upon opening the surface, there will be seen several little distinct sacs. The easy play of these valves must be much impeded by this state of disease: they must become stiff and rigid instead of being pliant, and floating easily with the tide of blood. The extreme tenuity of these valves, and the netted appearance of their edges, would incline us to believe that this also were a diseased state. But these deficiencies in the valves do not allow the blood to pass them; they are only upon the edges, where the valves are in contact when in action. The appearance being as common in children as in adults, teaches us, that these holes are not worn by attrition*. It does not appear that there is an instance of any part of an animal body being liable to such a waste: it is endowed with powers to counteract it. These valves have been found ruptured too; and this we should naturally attribute to the force of the retrograde blood, and thence argue a great force in the contraction of the arteries. It is not impossible, however, that they might, when diseased, have been ruptured by the violence of the heart's contraction occasioning a great degree of dilatation in the root of the aorta, which they (being at all times more unelastic) might be unable to bear.

The MITRAL and TRICUSPID VALVES are subject to the same diseased thickening, and to have concretions formed in them. In Plate IX. fig. 4. a view is given of the mitral valve of the right side of the heart in this state of disease. Their small tendons, too, if narrowly observed, will be found partaking in the disease, not uniformly of the same colour, but partly opaque, partly more transparent.

EXPLANATION OF PLATE IX.

FIG. I.—The arch of the aorta enlarged; with a portion of the lungs, containing a calcareous concretion attached to it—1, 1, Concretions in the artery seen upon its outer surface by the drying of the coats—2, The concretion in the lungs.

FIG. II.—A part of the aorta, where it proceeds from the heart slit up—1, Points to the opacities in the diseased aorta, which, when further advanced, contain gritty matter—2, The semilunar valves thickened, and partaking of the diseased state of the coats of the artery—3, Concretions formed below the valves.

FIG. III.—The coats of the aorta at its bifurcation into the iliac arteries, held thus extended, though dried, by an extensive scale of ossification.

* Continued pressure seems to have a greater effect in causing absorption; as in tumors pressing upon the bones, in the growth of the permanent teeth encroaching upon the temporary teeth, or in the beating of arteries and aneurismal tumors upon the bones. But all these are imperfect analogies. The part which possesses the greatest vigour is not absorbed, but remains unaffected, whilst the other is wasted, as in the teeth; and soft parts resist while the bone is absorbed.

FIG. IV.—The mitral valve loaded with concretions.

FIG. V. The femoral artery in a diseased state, with its coats dissected—1, 2, The outer coats of the artery dissected into two layers—On the other side, 3, they are separated into three layers. The muscular coat is exposed with its fibres running in circles round the artery : It is inaccurately marked 3 in the text—4, Is the inner coat of the artery, with scales of ossification connected to it.

FIG. VI.—The femoral artery dissected from the stump after amputation—1, The great ligature tying the trunk of the artery, and including a branch (2) of the anterior crural nerve—3, Another branch of the nerve included in the ligature tying a smaller branch of the artery—4, The crural nerve—5, The clot reaching up into the pervious part of the artery, and adhering to its side—At 6 the clot coalesces more intimately with the coats of the artery—7, Part of the cellular membrane which surrounded the artery condensed by inflammation, and adhering to it.

FIG. VII.—The splenic artery ossified—1, 1, That part of the artery, which, being membranous still, has shrunk in the drying—2, Scales of concretions almost totally surrounding the artery.

FIG. VIII.—The artery of the stump left more rudely dissected than in Fig. VI.—1, The cavity of the artery—2, The clot—3, The inflamed cellular substance surrounding the artery. The accompanying vein is seen opened likewise, and its coats much thickened.

FIG. IX.—The femoral artery, with a ligature upon it for the cure of the popliteal aneurism.

2, A piece of wood included in the ligature 3,—4, A probe passed into the artery where its coats were cut by the ligature.

DISEASED APPEARANCES IN THE THORAX, INDEPENDENT OF THE HEART AND GREAT VESSELS.

PLEURA.—The investing membrane of the thorax has the same structure with the peritoneum. It is a simple membrane, with many vessels ramifying in it. These, in their natural state, secrete a halitus, or rather they, unremittingly, perspire a fluid which moistens the surface, and prevents the lungs from adhering to the pleura costalis. When this natural secretion is vitiated, when the vessels are dilated, or the reabsorption of fluid obstructed, there is dropsy of the chest, and then we find frequently a white or yellowish turbid matter adhering to the side of the chest, or surface of the lungs.

OF ADHESIONS OF THE LUNGS.—Adhesions of the lungs to the pleura, where it lines the ribs, or where it covers the pericardium, are so frequent, that they need scarcely be considered as a disease, at least they are of no account in investigating the cause of death ; for it would appear that the slightest inflammations during any period of the patient's life, even from colds which pass unobserved, produce adhesions which are never afterwards removed.

To account for the more frequent occurrence of inflammation and adhesions in the membranes of the breast, there have been several hypotheses suggested ; and particularly it has been said, that the vessels which supply these interior membranes are branches of arteries common to the pleura and integuments of the breast ; and that the outer branches being more liable to occasional derangement in their action, an accumulation is brought upon the inner branches. But the distribution of the mammary and intercostal arteries, when compared with the epigastric in the abdomen, or with the distribution of vessels to any other internal membrane, does not support such a conjecture ; for they also have external

branches; and if there be found a greater frequency of inflammation in the thorax, it may rather be imputed to the peculiarity of the lungs as inhaling the air, and being consequently more liable to suffer from the vicissitudes of the weather.

CONSEQUENCES OF INFLAMMATION.—Inflammation existing immediately before death often throws out a layer of coagulable lymph upon the pleura; and it can be felt upon the inner surface of the ribs, and torn from them with the fingers, a tremulous gelatinous layer; or upon the surface of the lungs a jelly is thrown out, which can be wiped away with a cloth. These exudations approach in their more advanced stages to the appearance of membranes, and can with difficulty be distinguished from the original membranes. Any vacancy found in the thorax from disease, as from the destruction of the lungs of one side, and the formation of pus, is generally accompanied with these layers of coagulable lymph upon the inner surface of the ribs, and with inflammation and thickening of the pleura; or we find a ferous fluid in the bottom of the chest, with flakes of the coagulable lymph, like membranes, floating in it.

When the lungs become diseased, and abscesses are formed in their substance, the inflammation extending round them, and communicating through the pleura pulmonalis, or external coat of the lungs, forms adhesions betwixt the lungs and ribs or pleura costalis. By this means the matter of the abscess, when it has made its way out of the lungs, is still held confined in a sac, and prevented from spreading freely into the whole cavity of that side of the chest. From this pervading of the inflammation previous to the bursting of an abscess in the lungs, we have frequently this appearance upon opening the breast: the lungs are compressed, hard, and apparently incapable of their function; coagulable lymph is extended upon the surface of the pleura; partitions are formed extending from the inner surface of the ribs to the collapsed and hardened lungs; sinuses of matter are seen running among these irregular adhesions, and the lungs themselves, if far advanced in the disease, are full of pus in many places, which escapes upon their outer membrane being torn open.

OF EMPYEMA.—This is matter lodged betwixt the lungs and pleura. The abscess or vomica in the lungs, and the matter in the pericardium or mediastinum, is not empyema, until they have burst and diffused the matter in the cavity of the breast.

Collections of matter may be formed in the cavities of the chest, independent of the lungs, from the inflammation of the pleura advancing to suppuration; and collections of matter, or of serum, have been found betwixt the pleura costalis and the ribs, which have pushed the pleura in upon the lungs, and compressed them. It would seem to be a general opinion, that matter formed in the membranes, independently of the lungs, has a greater tendency to open outwardly by the intercostal spaces, than that matter which, though lodged in the cavity of the chest, was originally derived from the lungs. In fact, the true empyema is often occasioned by injuries from falls or violent exercise, as wrestling, followed by deep pain in the breast. Rupture and laceration of the intercostal muscles is much dwelt upon by the older writers, as a cause of empyema; in these contusions and injuries of the bones, the matter more readily finds its way outwardly. See page 40. It is not by the pressure of the lungs in expanding, as sober physicians write, that the matter of empyema has sometimes been naturally evacuated by the side, but by the communication of inflammation and ulceration; and the old practice of burning the side, or making an incision until the pleura was bare, had the effect probably of procuring a tendency to this natural evacuation.

OF THE LUNGS IN A STATE OF DISEASE.—In cutting into the substance of the lungs of consumptive people, the most frequent appearance is groups of little white or variegated tubercles. These, in a more

advanced stage of the disease, make the surface of the lungs hard and irregular; and when the lungs are cut into, the tubercles are found to be larger, and to have run together into masses, and commonly little abscesses or vomicae have formed in them;—or, the tubercles being distinct, they are found to contain a white thick pus. In their still further advancement, they have totally degenerated into matter, which is contained in distinct sacs; and the whole lungs gradually approach to that state which has already been slightly described, viz. the lungs contracted, and with hard cartilaginous or schirrous tumors,—small purulent abscesses, or large vomicae, and stuffed up with innumerable irregular tumors,—some dormant, others inflamed and suppurated. The term Vomica, should be confined to the lungs perhaps, but faculated collections of matter in the pleura, or intercostal spaces, are also termed vomicae by authors.

I have found tumors projecting from the surface of the lungs, and interspersed widely in their substance, of quite a different texture from these tubercles, being of a very vascular and porous, or cellular nature, or, in other words, bloody tumors. Those upon the surface are of a reddish colour, and covered with a smooth membrane. They have no tendency to suppuration. I have found them in a subject, where there was a similar diseased structure in the liver, and lymphatic glands, and in the substance of the testicle.

In pneumonia in general, there is redness on the surface of the lungs; perhaps a universal dark redness in the cavity of the chest, a white or bloody serum is effused, and in the bronchiae there is often a gelatinous effusion or mucous matter. In those dying in the early stages of the disease, this effusion of a thick fluid-like pus, is the immediate cause of death; or a termination still more suddenly fatal, may have been occasioned by the effusion or extravasation of blood into the cellular texture of the lungs interrupting their function. And in these cases, or as in the fever of the West Indies, the lungs being found like a sponge filled with blood, the pain shall have borne no relation to the danger, there being an inability of expanding the chest, more than local pain.

OF THE STATE OF THE LARGE VESSELS IN ABSCESS, &c.—In large abscesses of the lungs, where they are in a manner degenerated into sacs full of matter; or in that still more extraordinary state of the viscera, where one of the lungs is wasted to the mere bud of its root, and the whole side of the chest is left empty, with a mixture of pus and water in the bottom of it—the pulmonic vessels have been found with open mouths, as if opening into the chest. In general, in this state of the lungs, the vessels will be found contracted at their extremities for about an inch and a half, and cartilaginous to the feeling; or instead of this, probably in a less advanced state, there have been found coagula formed in their extremities, plugging them up like the artery of a stump after amputation. From examining the state of large arteries, either when stopped by ligature or by an effort of nature, as in the formation of abscesses, it would appear that the formation of coagula depends much, if not entirely, upon the coats of the artery. In ulcerated surfaces, and in the formation of matter (as in the present instance, in the lungs), the coats of the artery, partaking of the inflammation in which it is involved, and which extends from the surface ulcerated to the surrounding parts, form a clot by the exudation from the inner surface of the vessel, and partly from the mass of blood in its cavity.—And the clot thus formed has a firm hold upon the sides of the vessel, and an intimate connection with it. It is the connection with the surrounding parts which supports the artery of an aneurism, or of a stump, after being tied. This connection, by supplying its little vessel, gives support to its inflammation, and assists in the production of a healthy clot. But if the artery be left exposed in the middle of an abscess, or left dissected from the surrounding parts, then that part which is exposed will have no proper clot or contraction of its coats; but the coagulum which stops the bleeding will be found at that point of the artery which has a connection with the surrounding flesh. If, again, the coats of a vessel tied in an aneurism (as that marked in

fig. IX. Plate X.) be diseased, partaking of that ossified state which has already been fully described as accompanying the dilatation of arteries, they will probably (as in the case from which this drawing was taken) be rendered by irritation unsuceptible of active inflammation: and upon the cutting of the artery by the ligature, there will be found no proper clot formed in the artery coalescing with its coats, so as in time to form a complete union; but, on the contrary, there is nothing to restrain the blood from flowing but the mechanical tying of the ligature, so that immediately upon the cutting of the artery by the ligature, the blood escapes. It is certain, that in those dissections described by Haller and others, in which the mouths of the trachea and great vessels were seen projecting from a remaining bud of the lungs, the clots must have been formed a little within the mouths, and the vessels closed up in the common manner.

OF CONCRETIONS OF THE LUNGS.—In Plate IX. fig. 1. is represented an earthy concretion adhering to the aorta: It was found in the lungs of a phthysical subject, and is rather a frequent occurrence. The lungs were indurated, and adhering in many places;—they seemed to have suffered much inflammation, and adhered firmly to the pericardium and great vessels. There were many such masses of calcareous concretions throughout the lungs; and this part was kept attached to the diseased aorta, as at that time I thought it might have had some connection with the diseased state of its coats. These calculi in the lungs are found in irregular cysts, crumble easily in the fingers, but take a stony firmness when dried. They grate upon the knife in dissecting the lungs; and, it would appear, are sometimes found in the extremities of the branches of the trachea. I have seen them so large as to press upon the aorta and upon the trachea, turning them from their seat.

The lungs are not unfrequently found turgid with air, and incompressible, not subsiding upon the opening of the thorax, nor even when pricked with the knife. In such cases they are sometimes red with blood, or are spotted with black extravasated blood upon their surface;—or when cut into, thick pus is gradually expressed from the small branches of the trachea (as was the case of the subject from which Plate VI. was drawn), or much froth is found in the branches of the aspera arteria; and when cut into, they are found stuffed with viscid slimy matter.

The colour of the lungs, too, must be observed, whether affected by inflammation, or whether seeming to be more permanently changed:—they may be found blanched and pale, or of a cineritious colour, from the loss of blood; or they may be found variegated in their colour, betwixt a purple and a lake, studded with white opacities, produced by tubercles. It must be always remembered, that in dissection, allowance should be made for the gravitation of the blood towards the back part, the body lying supine after death. The patient dying, or soon after death being left, upon his side, will occasion the blood to gravitate, and then coagulating, to give the appearance of disease.

OF EXAMINING THE TRACHEA.—It will frequently be necessary to examine the inside of the TRACHEA through its whole length, as it is often the seat of disease. It may be necessary to examine it to know the cause of suffocation:—it may be compressed by tumors;—it may be eroded by obstinate ulcers; it may be inflamed, and polypous membranes may have been thrown out from its inner surface, which being sometimes expectorated, resemble veins; being moulded to the branches of the trachea, and pervious. When the trachea is to be examined, in order to trace a disease which is connected with the lungs, the incision may be continued from the thorax upwards upon the fore part of the neck, and the trachea laid bare:—and being cut below the thyroid cartilage (or even the whole larynx being dissected out), it may be dissected from the œsophagus, and carried down to its bifurcation in the lungs; it being kept at the same time attached to the lungs by its branches. It can then be opened upon its

back part, and slit down its whole length, when any polypous membranes thrown out by inflammation may be distinctly shown, and traced in their progress in the lungs. When the trachea is replaced, and the incision upon the neck sewed up, the body is left in no way unseemly about the face; which in private dissection must always be avoided.

The Dissection of the Diseases of the Throat will be afterwards considered in treating of the Neck and Head.

DISEASED APPEARANCES IN THE MEDIASTINUM.—The POSTERIOR MEDIASTINUM which surrounds the great vessels that run down the spine behind the great viscera of the thorax, is not unfrequently the seat of disease. The lymphatic glands which lie at the root of the lungs are sometimes diseased; they are enlarged; or gritty matter is found in them which grates upon the knife; or they are found in a state of suppuration. Their disease will perhaps account for some of the symptoms which may have occurred during life; for they may be found to have compressed the trachea, the œsophagus, or the great vessels, as the aorta, thoracic duct, or vena azygos.

When the conglobate glands are affected in one part, it will be found more or less a general disease in the thorax, in the course of the aorta and iliac vessels, in the mesentery, &c. When abscess forms in the posterior mediastinum, it has no outlet, and it has been known to make very strange and extensive sinuses amongst the cellular membrane.

The ANTERIOR MEDIASTINUM differs in no respect as to its diseases from other deposits of cellular membrane where there is much fat and many glands and blood-vessels: it is subject to inflammation and the formation of abscess. Matter here has destroyed and rendered carious the sternum, forming a soft tumor, with fluctuation above the bone. In such cases, the pulsation of the heart being communicated to the matter, an aneurism has been presumed, and the patient terrified with the idea of sudden death.

A great accumulation of fat here has been considered as a serious disease, and even upon dissection assigned as the cause of death.

The premature accumulation of fat upon the viscera may be considered as a disease, though in old people it is natural. This load of fat upon the viscera is the last stage which the adipose membrane undergoes from the fœtus to old age. But the qualities of the fat, and its place of deposit, are more changed than its quantity. It is not drawn from the extremities to the heart and viscera, but from the surface to the interior parts. In the fœtus, when the hard and unelastic integuments are dissected off, the muscles are left bare, and the further dissection is easy, the fat being firm and insulated, and external chiefly. Here the delicacy and neatness and beautiful form of the muscles and tendons will be more the object of admiration than even in the adult. The integuments of the fœtus in delivery is its great strength. In a youth, whose limbs have become shapely, the fat is more equally diffused over the interstitial cellular membrane, the dissection becomes more difficult. And in old age it has become still more tedious and impracticable; for every part oozes out oil, and the dissection can never be freed from fat. The fat, which to the infant gave unformed rotundity, and to the middle age symmetry and shape, has left the integuments, and is more equally distributed; it is now more accumulated about the internal parts, and more intimately blended with them. The fat does not remain in the cells any length of time, but, like the rest of the body, it must suffer a perpetual series of changes; be resumed into the circulating system, as subservient to other uses, whilst the cells are at the same time filling with a new deposition. It is natural to suppose, that the state of the fat changes with that of the solids, and has a strict connection with the economy of the body. Yet how insufficient is that explanation of the accumulation of fat about the viscera which assigns to it the use of rendering pliant

and easy of motion these important parts which are now stiff and inactive with old age : it is to suppose the most important viscera of the body to be greased like the wheels of an engine.

The membranes of the body, though loaded with fat, are not oily upon their natural surface : the attrition of surfaces in an animal body is prevented by their own secretion ; and the animal oil, though it escapes upon the adipose membrane being flit up, yet in the living body cannot transfuse, to oil the moving parts. It is not long since the opinion was entertained, that the fat was laid in the track of the coronary vessels of the heart, to preserve them from those diseases to which the arteries were liable in other parts of the body ; the evil consequences of which would be manifold in the heart.

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P A R T III.

CONTAINING

THREE DISSECTIONS OF THE PERINEUM,
INFERENCES DRAWN FROM THESE VIEWS OF THE PARTS,
THE SECTION OF THE PELVIS,
POINTS OF SURGERY ILLUSTRATED BY THE SECTION OF
THE PELVIS,

THE CONTENTS OF THE PELVIS AS SEEN FROM BEHIND,
AND PLAN OF THE ARTERIES,
OF THE DESCENT OF THE TESTICLE,
OF HERNIA, HYDROCELE, &c. AS ILLUSTRATED BY THE
ANATOMY OF THE TESTICLE,

OF THE INVESTIGATION OF DISEASE IN THE PELVIS,
AND OF THE MORBID STATE OF THE PARTS.

WITH PLATES.

SECOND EDITION.

BY CHARLES BELL, SURGEON.

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1800.

SYSTEM

DISSECTIONS

PART III



1800

A
SYSTEM
OF
DISSECTIONS.

ANATOMY AND DISEASES

OF THE

PELVIS.

DISSECTION OF THE PERINEUM,

Or of those Parts which are chiefly implicated in the Operation of Lithotomy, and in the Diseases of the Urinary Passages and Rectum.

PREVIOUS to the dissection of the perineal muscles, the arteries of the pelvis and of the lower extremities ought to be injected, that the important branches of the pudic artery, and their connection with those muscles, may be understood. The cavernous bodies of the penis should also be injected, and the subject placed upon the table as the patient is held for the operation of lithotomy.

FIRST STAGE OF THE DISSECTION

GENERAL VIEW OF THE PARTS TO BE LAID OPEN IN THE FIRST STAGE OF THE DISSECTION.—In this dissection, as the muscles and delicate arteries to be demonstrated lie deep amongst much loose elastic cellular substance, it is of some consequence to mark the depth and level of the parts. Because, although at first the student is circumspect, dissecting with caution, perhaps with timidity; yet gaining courage as he proceeds, and finding that he is only separating the cellular membrane, he plunges with more determined strokes of his knife, till at last he, with much disappointment, finds the external sphincter of the anus, or the transversalis muscle, cut away, and the demonstration destroyed: like those surgeons who, being strongly impressed with the idea that deliberation is the characteristic mark of their ability, commence their operation with an affected gravity of countenance and tedious cruelty; while in the important stage all

is indiscreet hurry and confusion. In both cases the celerity and success depend upon the knowledge of the points in which caution is required.

The rectum having been ordered to be thoroughly cleaned, a little baked hair may be introduced into the extremity of the gut, which will keep the anus gently protruding during the dissection; or a cork with a loop attached to it being introduced, and the mouth of the gut tied upon it, the dissection will be much facilitated, and the demonstration assisted, in consequence of the complete management we have of the gut; for we shall thus be able to turn it in every direction, so as to show its connections.

The place of the *ERECTOR PENIS* (A A, Plate X.), being evident, since it rests upon the ramus pubis and crus penis, it cannot be destroyed, and should be our first object in the dissection, as serving, in some measure, for a guide in the dissection of all the other muscles. The next point in the dissection is the *ACCELERATOR URINÆ* (B), whose general course and appearance is sufficiently evident from the plate: its place we cannot fail to find, though the delicate fibres may be destroyed.

In dissecting the *EXTERNAL SPHINCTER* (C) we have to recollect, that it consists of loose fibres encircling the mouth of the gut, and lies immediately under the skin. This muscle is, however, frequently missed in dissection, and it is indeed difficult to show it neatly.

A sure guide in the dissection of all these muscles, but chiefly of the *TRANSVERSALIS PERINEI*, is the tuberosity of the ischium; for the transversalis perinei, taking its origin from the tough tendinous-like membrane of the os ischium, runs directly across to the general point of union, lying about two inches deep in the elastic fat, which fills the space betwixt the anus and os pubis. By carrying the knife in the course of this muscle, it will not be unwarily cut across; its fibres being, in this manner, much more easily distinguished, and extricated from the surrounding cellular substance.

MUSCLES.

EXPLANATION OF PLATE X. FIG. I.

A A, *ERECTOR PENIS*.—A neat and delicate muscle arising from the os ischium; stretches its muscular fibres over the lower part of the crus penis; and spreading its expanded tendon, gradually coalesces with the sheath of the crus penis.

B, *ACCELERATOR URINÆ*.—From the middle tendinous line, as from a common origin, the fibres, diverging, run obliquely upwards on either side, embracing the bulb and lower part of the corpus cavernosum urethrae with a coat of muscular fibres; which, collecting into distinct tendinous slips, are inserted into the crura penis.

C, *SPHINCTER ANI*.—The fibres of this muscle, running in circles round the mouth of the gut, it can scarcely be said to have an origin or insertion. It takes hold of the os coccygis behind, and is attached to the accelerator urinæ before: more intimately and immediately embracing the lower portion of the gut, are the stronger fibres of the *INTERNAL SPHINCTER*.

D D, *TRANSVERSALIS PERINEI* arises from the tuberosity of the ischium, is inserted into the central point of union, where the sphincter ani touches the accelerator urinæ.

Sometimes more deeply seated, and above the last, runs a slip of fibres, viz. the *TRANSVERSALIS PERINEI ALTER*.

OF THE BLOOD-VESSELS IN THIS STAGE OF THE DISSECTION.

All the *ARTERIES* seen in this stage of the dissection are branches of the pudic artery. The pudic is sometimes named the *EXTERNAL HÆMORRHOIDAL ARTERY*; but,





Fig. 2.

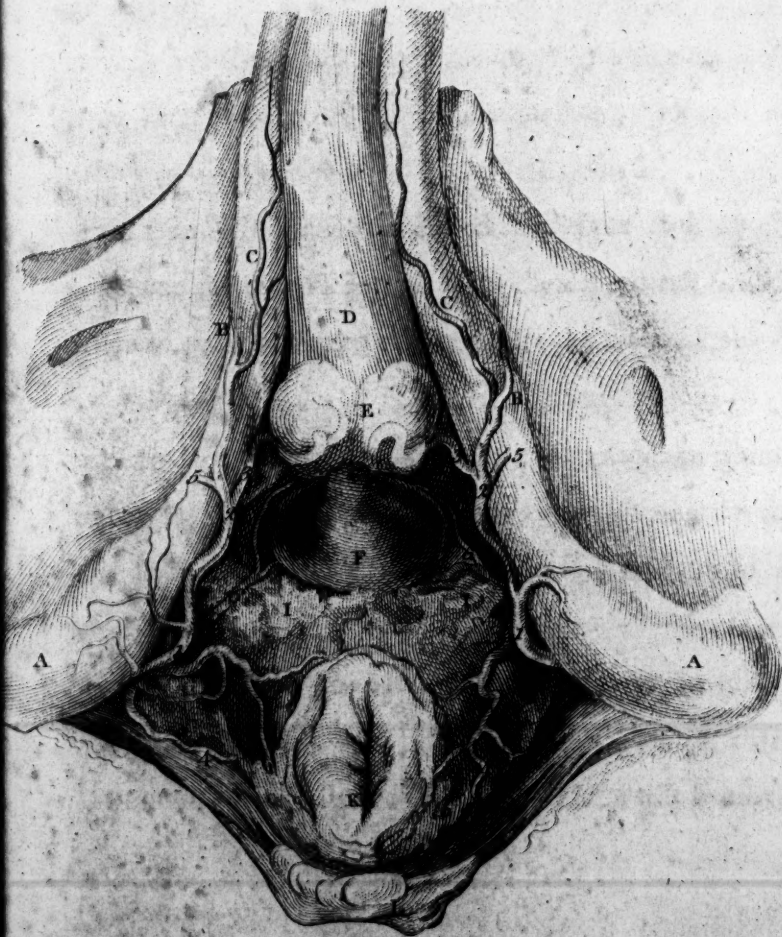
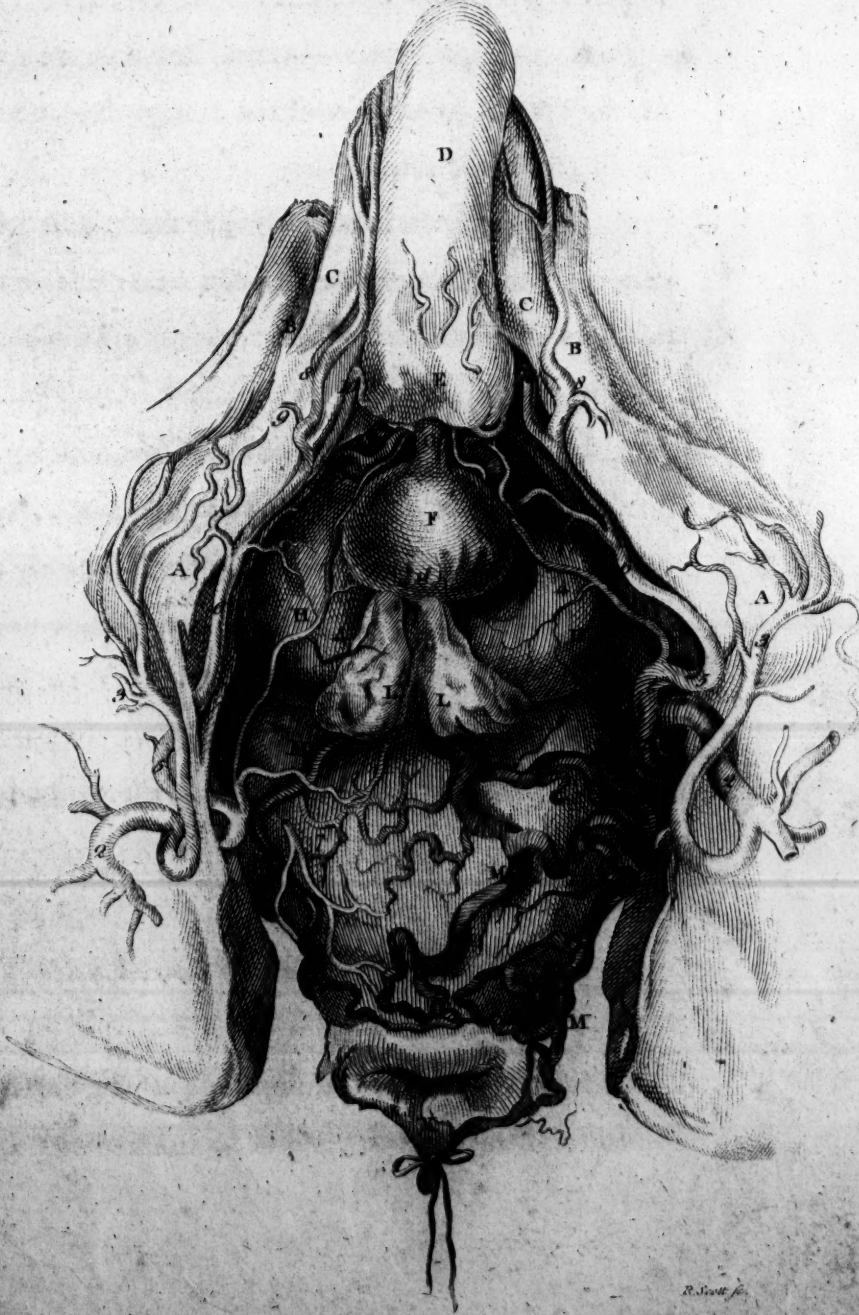


Fig. 3.





1. Is properly the **EXTERNAL HÆMORRHOIDAL ARTERY**; which, branching upon the extremity of the rectum, and enveloped in the muscular fibres, furrounds the anus.

2. That artery, which is prolonged by the side of the bulb of the urethra, and gives off twigs over the erector penis and crus penis, is the superficial branch of the pudic artery, or the **ARTERIA PERINEI**.

3. The **TRANSVERSALIS PERINEI** is a branch from the last artery, distributed in the cellular membrane, and to the sphincter ani.

The place of this artery is often supplied by several irregular branches.

The **VEINS** which are seen in this dissection, are the pudic or inferior hæmorrhoidal veins, and accompany the arteries.

The **NERVES** which appear in the course of this dissection, are the pudic nerves coming from the second and third sacral nerves (see Camper). They run sometimes over the transversalis perinei muscle; more frequently below it; sometimes they come out in one branch, sometimes in several twigs. But the veins and nerves are of less consequence to be studied than the muscles and arteries.

SECOND STAGE OF THE DISSECTION.

EXPLANATION OF FIG. 2.

To bring the parts to correspond with the drawing of figure 2. we must disregard the muscles entirely, pursue the delicate branches of the arteries in a retrograde course (dissecting with the scissors chiefly), till we have cleared the muscles and cellular membrane entirely away, and have a more connected view of the arteries, with their distribution to those more important parts which now come into view.

LEVATOR ANI. In the course of this dissection, we have to observe the intricate connections of the levator ani muscle: It will be seen coming down from the neck of the bladder and triangular ligament of the urethra, and from the fibres of the sphincter vesicæ; and in stronger fasciculi from the sides of the pelvis, converging to the anus, and mixing its fibres with those of the internal sphincter.

A A, TUBEROSITY OF THE OS ISCHIIUM.

B B, RAMUS PUBIS.

C, CRURA PENIS.

D, CORPUS SPONGEOSUM URETHRÆ.

E, BULB OF THE URETHRA.

F, PROSTATE GLAND seen much retired.

G, MEMBRANOUS PART OF THE URETHRA. In dissecting which, we have to observe, what has been called the triangular ligament of the urethra; it will appear as of a middle nature, betwixt muscle and tendon, furrounding the urethra, and connecting it and the prostate gland with the arch of the os pubis. It gives strength to the membranous part of the urethra; and being perforated by numerous veins coming from the penis, it has been described as cavernous.

H, The BLADDER, obscurely seen.

I I, The CELLULAR MEMBRANE interposed betwixt the bladder and gut.

K, The ANUS.

L, OS COCCYGIS.

ARTERIES.

1. The **ARTERIA PUDICA COMMUNIS**.

2. The **PUDIC ARTERY**, dividing into the **PERINEAL**, and the deep seated branch or **ARTERIA PENIS**.

3. The ARTERIA PENIS, the division of which into the artery of the bulb is seen, and its contortions marked by dotted lines upon the bulb; while the main branch proceeds upon the septum penis, and gives off the arteria dorsalis penis.

4. The EXTERNAL HÆMORRHOIDAL ARTERY.

5. The TRANSVERSALIS PERINEI ARTERY laid back.

6. The ARTERIA VESICALIS IMA going to the neck of the bladder and prostate gland.

EXPLANATION OF FIG. 3.

In this figure there is a further dissection of those parts illustrating the preceding figures. In the subject from which this was drawn, the pelvis and thighs were severed from the trunk at the lumbar vertebræ. Ligatures were put upon the femoral arteries to confine the force of the injection to the pelvis. The bladder and rectum were filled with tepid water, and the injection of the veins and arteries made. The muscles of the thighs originating from the pelvis being cleared away, and also the numerous branches of the obturator artery, with the profunda femoris and circumflex arteries, the thigh bones of both sides were cut through. And further, to give full room for the dissection of the arteries of the pelvis, and to bring them into a new view, the os sacrum and coccyx were taken entirely away; the perineum and parts of generation, with their arteries, were then carefully dissected.

The dissection was then placed so as to illustrate the preceding figures.

A B C D E F G H K L, have the same references as in figure 2.—But it may be observed, that the mouth of the gut K, being pulled downwards, and separated from the bladder H H, is consequently drawn from its natural seat; the prostate gland F, and urethra G, are more distinctly seen; while the vificulæ feminæ L L, which in the other figures lay hid betwixt the bladder and gut, are brought into view.

M M M, The hæmorrhoidal veins, and branches of the lower mesenteric veins.

N, Congeries of veins surrounding the neck of the bladder, chiefly derived from the vena ipsius penis.

In this figure a connected view of the perineal arteries is allowed.

1. A trunk, common in this subject to the posterior iliac artery or gluteal, and to the ischiatic artery.

2. The POSTERIOR ILIAC ARTERY.

3. The ISCHIATIC ARTERY.

4. The VESICALIS IMA of HALLER. Besides furculi from this artery, the neck of the bladder and prostate gland has twigs from the middle hæmorrhoidal artery, an artery of the rectum.

5. The PUDIC ARTERY (sometimes called the inferior hæmorrhoidal) at that place where it appears without the pelvis.

6. The PUDIC ARTERY, where it lies covered by the tuberosity of the ischium.

DISTRIBUTION OF THE PUDIC ARTERY.

7. EXTERNAL HÆMORRHOIDAL ARTERY.

8. PERINEAL ARTERY.

9. TRANSVERSALIS PERINEI.

10. The ARTERIA PENIS, the divisions of which cannot now be seen:—These, however, go to the bulb (the extremities of which are seen at 11)—to the body of the penis—to the cavernous body of the urethra.

12. The CORONARY VEINS of the neck of the bladder.

INFERENCES DRAWN FROM THESE SEVERAL VIEWS OF THE PARTS.

OF THE ACTION OF THE PERINEAL MUSCLES.—There is no combination of muscles more curious, or more deserving of our attention, than that of the muscles of the penis and rectum; whether we consider

the importance of the organs to which they are subservient, or the diseases with which they are connected:—yet both the natural action of those muscles, and their action and sympathies in the morbid state of the parts, have been much neglected; and the uses or actions attributed to them are surely very far from the truth.

OF THE ERECTOR PENIS.—Is it not more natural to conceive that the use of this muscle is to brace the crura penis to the bone, than to adopt that explanation of its action which has gained it its present name? Can we conceive any mechanism so well adapted to give firmness and occasional strength to the hold which the root of the penis must have upon the bone, as that of a muscle partaking of the same stimulus; inert when the penis is flaccid, and roused to action in proportion to the excitement of the penis?—To suppose it assisting the dilatation of the penis, by forcing the blood forward from the crura, is to attribute to it an action which would totally prevent erection, and not give firmness; the blood being excluded from the crura, could have no hold upon the os pubis. And the idea of its holding down the penis is (in spite of authority) ridiculous; since the pubes or adipose membrane betwixt the dorsum penis and os pubis, prevent further elevation, and render such an action in this muscle unnecessary.

ACCELERATOR URINÆ.—To understand the action of this muscle, we must recollect the relations of the bulb and lower portion of the cavernous body of the urethra upon which it acts. The *CORPUS CAVERNOSUM URETHRÆ* is a spongy body, surrounding the urethra from its membranous part under the arch of the os pubis to the glans. The *GLANS* is the enlargement of this body towards the extremity of the penis, whilst its lower part in the perineum is also enlarged to form the bulb. Within this lower part the canal of the urethra is dilatable into what has been called the *SINUS URETHRÆ*. Now this is strictly the operative part of the penis, and is raised upon the former support of the body of the penis, which alone by its crura, has a firm hold of the os pubis. When the glans is excited, the whole parts of generation are brought into action:—the *vesiculæ feminales* more gradually empty themselves into the urethra; when the accelerator, being drawn into action, propels their contents forward by successive pulsations. It may be observed, too, that this action upon the bulb, though partial, affects the whole extent of the cavernous body of the urethra, and has the effect of strengthening and making rigid that canal, so as to increase the velocity of the emission.

The erector and accelerator muscles are the only ones which can be conceived to have an independent action; and the accelerator is very strictly connected with the transversalis and sphincter ani. In that action of the accelerator which has been noticed, the sphincter ani, the transversalis perinei, and the levator ani, have a simultaneous action. The two first retain and steady the bulb of the urethra against the action of the accelerator; whilst the *LEVATOR ANI*, and muscular fibres about the neck of the bladder, compress the *vesiculæ*, and, constricting the urethra, prevent a retrograde movement of the semen.

Besides the action of assisting the muscles of generation, the sphincter, transversalis, and levator ani muscles, have the peculiar action of guarding the outlet of the pelvis; and give to the contents of the pelvis firmness and a degree of support, enabling them to preserve an equilibrium with the parts in the belly.

DISEASED ACTION IN THESE PARTS AFFECTING THE DISCHARGE OF SEMEN.—Whilst treating of the action of these muscles, the diseases with which they are connected form an important object; for though they are of rare occurrence, they are very interesting. An increased secretion from the *vesiculæ feminales*, or prostate gland, is frequently a cause of terror to patients, when there really is no diseased secretion of the semen.

In an instance of retention of the semen, these are the symptoms: “*Ni ce fremissement ni cette sensa-*

tion ne se soutenoient pas aussi long tems. La semence ne sortoit qu'en forme de bave, et à mesure que l'érection diminuoit (A)." We may explain such symptoms thus: The semen was not thrown retrograde into the bladder; for in that case it would have been evacuated only by an effort to make urine; but there being such an obstruction as to retard the vesiculæ seminales from disgorging themselves suddenly into the urethra, so as to distend and stimulate the accelerator muscle, the semen remained slowly moving through the urethra: or, what is more probable, the erection of the penis and spasmodic contraction of the muscles were such as to obstruct the passage of the semen until the relaxation of all the parts; a disease in which our expectation of relief is much better founded, than when there is an obstruction in the canal of the urethra. Much the same symptoms, I believe, are the consequence of ulcers having partially destroyed the accelerator muscle, when the power of expelling the semen from the sinus urethrae is lost.

Where the semen, instead of being thrown forwards, really falls backwards into the bladder, it may be difficult to say whether it may be owing to a relaxation of the muscular fibres surrounding the neck of the bladder, allowing to the semen a retrograde movement into the bladder, or whether it be owing to an obstruction before the verumontanum. The former is more likely, since such a retention of the semen is not accompanied with any interruption of the natural discharge of urine.

But there is a circumstance which may still farther explain the peculiarity in the evacuation of the semen: Whilst it flows, the state of the parts must be recollected, the tension, the fulness, during the venereal orgasm. In this situation of the parts, any caruncle or prominent obstruction suffers a kind of erection, whilst the canal is at the same time straitened by the erection. This may explain a circumstance which occurred in a case where the semen was thrown back into the bladder. The patient could not evacuate the urine for some time; and when, after a few minutes, it flowed, the semen was found settled in the chamber-pot. It has happened frequently, that mucus evacuated by stool in tenesmus has alarmed patients much, in a disease of this nature; as they immediately conceive this to be the semen coming by some strange preternatural passage.

In stricture of the urethra, where the urine flows with difficulty, it is curious that the semen is discharged naturally. But we must make a distinction betwixt an obstruction to the semen before it reaches the accelerator muscle, and one situated betwixt that muscle and the glans. Besides, the urethra in erection of the penis is much straitened and elongated; so that a stricture, which is firm and callous, and not apt to be affected by the fulness of the parts, should give comparatively little resistance, especially when we consider that the stretching of the urethra by erection (which we endeavour to imitate in introducing the catheter) will in a greater measure counteract the stricture.

In that affection of these parts which is considered as SEMINAL WEAKNESS, an attention to their action and importance in the economy will perhaps explain the nature of the disease. I should conceive, that the vesiculæ seminales receive the semen, not strictly as reservoirs; but that in these vessels it may be mingled with their peculiar secretion, so as to form, when diluted, a quantity of fluid fitted to be acted upon by the muscles of generation. Were the semen poured only from the vasa deferentia, there would be too small a quantity of fluid to be acted upon; nor would there be the same chance, nay, scarcely the possibility, of impregnation. We know, that the prolific power of the semen is not lessened by dilution; and indeed we are assured, that by the violent excitements of the parts, the prostate gland and all the mucus glands of the urethra contribute their secretions. By dwelling upon this, it is meant to point out the distinction betwixt those affections of the parts which are considered as seminal weakness, and any real affection of the testicle. Slight inflammations of these parts, weakness, or loss of tone, the discharge from the urethra, or gleet communicating with the vesiculæ seminales or prostate glands, will produce

(A) See Mem. de l'Acad. de Chirurgie.

an increased secretion, a permanent or temporary laxity and debility of the secreting parts; and their contents being accumulated, will be thrown out in straining at stool, or in the expulsion of the last drops of urine, without implying any peculiar affection of the secretion of the testicle, or any more general debility of the system.

OF ACTION IN THE RECTUM.—We shall perhaps come to admit, that a relaxation takes place in the sphincter ani, if we consider the manner in which the intestinal canal acts through its whole length. One portion of the gut being in action, propels its contents to that which is below, and which, relaxing, receives them. Were there not a relaxation in the lower portion, it would oppose itself to the contraction of the upper part.

In the same manner, the superior strength of the muscular fibres, surrounding the extremity of the rectum, is relaxed during the action of the rectum, which allows an easier expulsion of the faeces:—as, by a law of nature in parturition, not the muscular parts only, but the whole parts, are relaxed previous to their dilatation. It is from this peculiarity in the action of the rectum that I would explain the formation of piles in some instances, and the prolapsus ani. Irritation of the gut gives occasion to an almost imperceptible but constant effort to expel from the rectum; and this effort is attended with a relaxation of the lower part of the gut and of the muscles, which, in action, retain the parts, and counteract the pressure of the abdominal viscera and the occasional action of the abdominal muscles. By continued action of this kind (the usual tension being taken off), the parts swell by the influx of blood; the internal membrane is inflated with blood, and protruded, forming a species of the hæmorrhoids. The same explanation holds good in violent straining at stool in costive habits; and it should be recollected at the same time, that the contraction made higher in the rectum, may more easily retard the returning venous blood than the more active play of the hæmorrhoidal arteries, thereby causing a stagnation of the blood in the extremities of the veins.

OF INTUS-SUSCEPTIO AND PROLAPSUS ANI.—In the same manner we have to explain intus-susceptio and prolapsus ani. In the first instance, the gut being irritated at any point, the irritation causes a contraction, while in the superior portion of the canal there is an effort to propel downwards: the consequence is, that the portion contracted by the irritation is forced to slip into the lower portion of the canal. But how is it forced into the lower portion? this is not well explained. It appears evident to me, that this is the effect of the longitudinal muscular fibres; for a portion of the intestine, say six inches, being irritated, contracts. This contraction is not in the diameter of the gut only, but in its length, so that it shall be only of two or three inches; the consequence of which is, that the internal coats are gathered together and inflated, and pressed into the next portion of the gut; by this the contraction is increased and the disease continued. In irritable childhood this often happens; and I have frequently found upon opening children, that there were involutions of the gut without inflammation or adhesion, but which might be withdrawn by the mere weight of the intestine.

In prolapsus ani, that laxity of the internal membrane, which is the immediate cause, is frequently produced by irritation; and the internal membrane being first protruded, the effort of expulsion being continued, the irritation increases, and a great part of the gut is inverted. When this accompanies dysenteric affections or diarrhoea, where there has been violent tenesmus and bearing down, it is a most distressing symptom, especially when the counter indications prevent the proper remedies. In cases where there is local irritation (as from numerous ascarides in the rectum of children, or, as sometimes happens, from the stone in the bladder), the temporary or permanent relief from the irritation must be the first object, while astringents are applied to counteract the effect of the loss of pressure. The reduction is commonly accomplished without difficulty by a strong cone of paper softened (by moistening at the point) and

oiled. This is to be introduced into the gut with gentle but continued pressure; and when the gut is completely reduced within the anus, the cone is easily withdrawn, with little risk of its bringing down the intestine again.

In violent irritation of the rectum, as in long continued tenesmus of dysentery, the neck of the bladder sympathizes; and what produces relaxation in the gut causes a stranguary, or spasmodic constriction in the neck of the bladder. This we shall readily conceive, when we recollect the strict relation which subsists between the action of the rectum and of the muscles about the neck of the bladder in their healthy action. The ejection of the contents of both is not allowed at the same time, but requires an alternation of action; which certainly is in a great measure to be accounted for from the communications of the levator ani, since this muscle, arising from the brim of the pelvis, sends its fibres down upon each side of the neck of the bladder, and embraces it before it reaches the lower portion of the gut, into which it is finally inserted.

It may be observed here, that in all such protrusions, whether hæmnia or prolapsus ani, the most immediate bad consequence is the want of accustomed pressure upon the protruded part, which causes fulness and stagnation of blood. In prolapsus, the contraction of the sphincter and levator ani tend to increase the evil, by drawing like a ligature upon the protruded gut (B).

It is by such a view of the parts as we have in fig. 2. that we come to have a truer idea of the strict relation which they have to each other, of their sympathies in disease, and of what we should expect to feel in a morbid state upon examining by the anus. Thus in inflammation of the neck of the bladder, or enlargement of the prostate gland, the pain in making water—the frequent excitement to it—the pain stretching upwards to the kidneys, and extending along the penis to the glans—the pain upon pressure in the epigastrium—the sensation in the rectum of a tumor, or of feces ready to be expelled (which is occasioned by the swelling of the prostate gland);—do in some measure recapitulate to us the anatomy and sympathies among the parts.

The student, in dissecting these parts, should naturally be led to inquire concerning the direction of abscesses which so frequently run amongst the cellular substance; of such particularly as may be connected with the urinary organs, the urethra, or neck of the bladder; and of the fistula in ano, or such as run up by the side of the rectum.

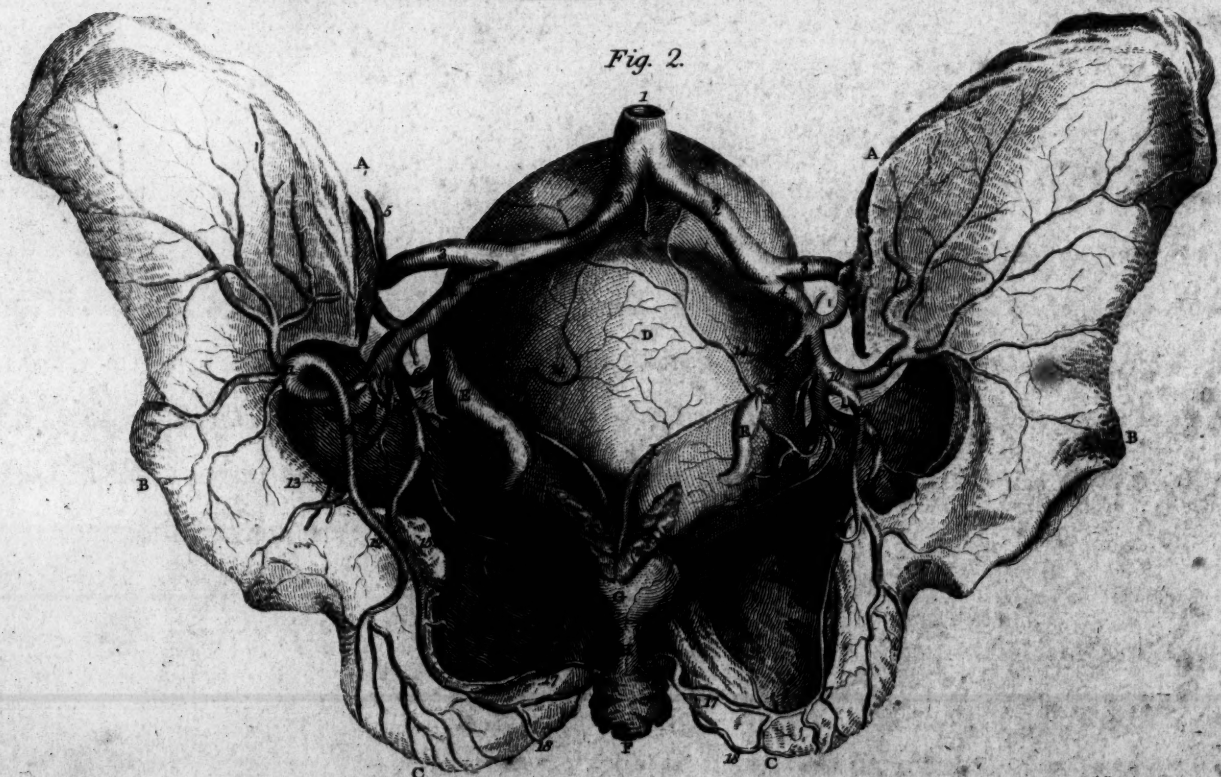
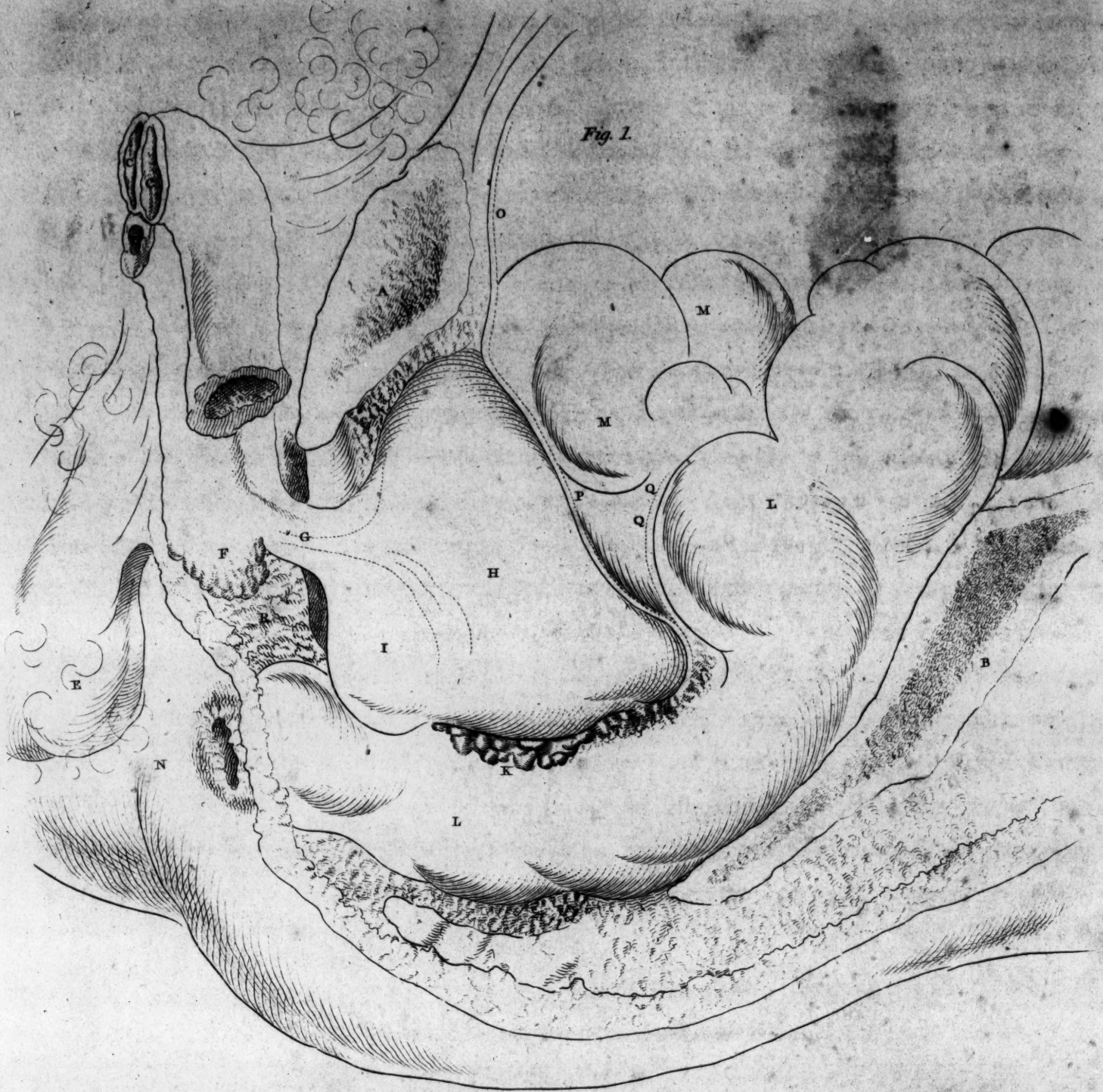
These abscesses, forming amongst the cellular membranes, become habituated and stationary; being long callous canals, which, by the condensation of the surrounding parts, acquire a smooth internal surface, and from which there is a perpetual discharge of matter. They are with difficulty brought to have any tendency to heal; and sometimes communicating with the gut, tease the patient with a local irritation in the rectum, and waste him with colloquative diarrhoea.

Although these abscesses amongst the fat and cellular membrane, in the bottom of the pelvis, are in general connected with the rectum, or have a tendency to open into it, a disease as dangerous is formed by the connection of these with the urethra. Not only those formed forwards in the perineum, will have formed fistulous communications with the urethra, but those formed about the anus will stretch towards the urethra, destroying the cellular substance which surrounds it.

We see evidently, from the numerous arteries here, how liable we may be to mistake the most common indurated tumor for an aneurism, having a distinct pulsation communicated to it by its contiguity to these vessels:—yet we have reason to be astonished, that aneurism of these vessels is not frequent, more especially in the female pelvis, where the parts are so liable to disease, and where they are subjected to occasional pressure, dilatation, or sudden relaxation.

(B) The consideration of the diseases of these parts is resumed in a subsequent Section.





OF LITHOTOMY.—Upon turning our attention to fig. 1. we find, that the external incision in lithotomy must run in the direction (***) upon the left side of the perineum, cutting directly through the transversalis muscle, cutting a few fibres of the sphincter, and going deeper, or more penetrating in the middle, so as to reach into the membranous part of the urethra. In laying open the groove of the staff, it is very awkward to cut the bulb of the urethra. It nevertheless does sometimes happen, that it is not cut only, but minced with many transverse cuts. And authors mention a more distressing circumstance still, viz. the blood having been seen flowing from the anus, in consequence of the incision having been carried too low upon the gut, and the gut and hæmorrhoidal vessels cut.

It is a more frequent, and very embarrassing accident, when the pudic artery is cut by carrying the knife too near the bone: the vessel must be tied before proceeding. When the perineal artery is cut (and indeed it can hardly escape) it does not, in general, interrupt the operation.

Some or all of these vessels bleed in the operation of lithotomy, and choke up the wound with coagulating blood; so that the operation must be done much more in the dark than we should conceive from the view of the dissected parts.—And this should teach us how necessary a strong conception of the anatomy is; not simply such an idea as can enable us to dissect the parts, but a knowledge of the feel also of the different parts, so as to be able to distinguish them by the finger.

A thickened and indurated state of the bladder has been a frequent cause of the failure of this operation: For although, when the gorget is said to have gone betwixt the bladder and rectum, it is generally conceived that the operator, in his hurry and trepidation, has never fairly cut the urethra and groove of the staff, but has passed his gorget onwards, unguided, amongst the cellular substance; this certainly has happened; yet it would appear as likely, that in this case the bladder had been pushed forwards upon the staff by the gorget, without the instrument having penetrated the bladder, or cut through the prostate gland.

OF THE SECTION OF THE PELVIS.

EXPLANATION OF PLATE XI. FIG. 1.

In the rude plan of the section of the pelvis given in Plate XI. fig. 1. and which is taken with little variation from Camper, it is supposed to be cut by the symphysis of the os pubis (A), and the ilium (B) at an equal distance betwixt its symphysis with the sacrum and the acetabulum. We must be aware of the confusion of parts which this presents, and that it is a tedious and difficult dissection clearly to demonstrate all the parts; the bladder, urethra, prostate gland, vesiculæ seminales, ureters, and rectum, with their connections, even without their blood-vessels, and to retain them in their natural situation.

A, The OS PUBIS divided by its symphysis.

B, The OS ILIUM divided.

C, The CORPORA CAVERNOSA PENIS.

D, The URETHRA, surrounded with the corpus cavernosum urethræ.

E, The SCROTUM.

F, The BULB of the URETHRA.

G, The MEMBRANOUS PORTION of the URETHRA. In dissecting here, we have to observe the ligamentous substance surrounding and strengthening it, and how it is embraced by the sphincter vesicæ.

H, The BLADDER, as described by Camper, falling into a triangular shape, the base of which rests upon the rectum. The muscular fibres of the bladder are very formally represented by ALBINUS, inserted into

the os pubis. CAMPER cannot distinguish this insertion. The drawing of ALBINUS would mislead us; since no such regular muscle is to be seen, and since the muscular fibres are loose and irregular, and involved in the connecting cellular membrane: But ALBINUS, in as much as relates to the origin and insertion and general direction of the fibres, is invariably true.

I, The PROSTATE GLAND, which must be felt, not seen, amongst the confusion before dissection.

K, The VESICULÆ SEMINALES attached to the lower part of the bladder, immediately behind the prostate gland.

L, The RECTUM, taking the course of the os sacrum and os coccygis.

M, The CONVOLUTIONS of the INTESTINES in the lower part of the belly.

N, The ANUS.

O P Q, A dotted line, representing the course of the peritoneum. O, where it covers the abdominal muscles and pubes;—P, where it is reflected upon the bladder;—Q, where it turns over the rectum, and forms its outer coat.

REVIEW OF THE PARTS AS SEEN IN THE SECTION OF THE PELVIS.

The BLADDER is, upon the upper and back part, covered with the smooth expansion of the peritoneum;—on the lower and fore part, and contiguous to the lower portion of the rectum, it is imbedded in cellular membrane, in which abscess makes rapid progress. The bladder upon distention rises before the intestines M, M, keeping close to the pubes (A), and carrying the peritoneum (O, P,) before it; so as, when much distended, to appear above the os pubis, and to allow of its being punctured, or even to permit the performance of the high operation for the stone without piercing the peritoneum. As it rises, however, the lower part of the bladder does not proportionally protrude, but rather (in the subject) retires from the perineum as the bladder fills.

During dissection, the place and degree of curve of the urethra should be carefully observed, as of the last importance, in all operations in the perineum. It may be observed how strongly the membranous part of the urethra, or that portion of it which is betwixt the bulb of the urethra and the prostate gland, is supported by the fasciculus of fibres or ligamentum triangulare, and how much dissection it requires to show its membranous nature. In the healthy state of the parts, it seems almost impossible that such rudeness should be employed as to rupture the urethra with the catheter; yet this happens in the diseased state of the parts. Such an accident, however, is more frequently the consequence of continued pressure of bougies; which being with difficulty directed in the curve of the urethra, make their way into the interstice filled with cellular membrane (R), betwixt the neck of the bladder and rectum, and sometimes into the rectum itself; forming a constant draining of urine into the rectum, and exciting in consequence perpetual diarrhoea and tenesmus.

The PROSTATE GLAND (I), which is seen surrounding the neck of the bladder, when swelled by any of the causes enumerated below, compresses the canal of the urethra: but a more complete obstruction to the introducing of the catheter arises from its swelling irregularly, or pushing forwards, so as to increase the sudden curve of the urethra, or to shift it aside. In the same manner, tumors, or even abscesses, by distorting the urethra, cause difficulty of passing urine. We see an instance of the distortion of the urethra causing retention, where the bladder is contained in the hernial sac. But in this case, much of the difficulty of passing urine arises from a degree of weakness in the bladder itself, and from its also having lost the co-operating pressure of the abdominal muscles.

This outline of the section of the pelvis may illustrate another circumstance much dwelt upon by Camper, viz. the point of the catheter being prolonged too far beyond that part of its curve which should be

adapted to the curve of the urethra :—the consequence of this is, that when it is fully introduced, the point reaching the back part of the bladder pushes it before it; and the coats of the bladder, clinging round the catheter, prevent the urine from flowing; or if the instrument be continued in the bladder, there is great risk of the bladder being hurt by the point of the instrument. Cases have occurred of its making way into the rectum.

It may be observed, too, how much of the bladder is, in founding, under the curve of the staff; how a stone gravitating into the lower part may be over-reached by the staff or catheter, and no grating be felt but by forcing the convexity of the staff downwards in founding. The stone falling into this more depending part of the bladder, in the prevailing posture of the body, may form a lodgment there. This would undoubtedly more frequently happen, did the bladder always retain its natural pliancy and thinness of its coats; but the consequence of the presence and irritation of a stone in the bladder is a thickening and contraction of the coats, which must prevent the formation of cysts.

In puncturing the bladder from the rectum, independently of the very awkward circumstance of the canula remaining in the intestine, the proximity of the seat of disease (in the neck of the bladder or prostate gland) becomes a great objection. We see also, from the plan, how in this operation the prostate gland being enlarged it may be mistaken for the bladder, and the trocar plunged into its solid substance, so that no urine can flow upon withdrawing the filet.

In puncturing by the perineum also, we must recollect, that if the disease be in the prostate gland, it is enlarged, so that there is a great probability that the trocar shall be passed into the substance of the gland, without penetrating into the bladder.

I have seen an instance of the trocar in this operation having passed through the urethra: upon withdrawing the filet no urine flowed from the canula, because it had transfixed the urethra (which had been dilated behind the obstruction); but upon withdrawing the canula a little, and freeing it from the opposite side of the urethra, the urine flowed in full stream. The canula upon this was further introduced again; but, instead of taking its former direction, it slipped along the urethra, and found its way into the bladder by the natural passage. This appeared upon the dissection.

In the subject, or in the annexed plan, we see how the bowels press down into the pelvis in the erect posture of the human body: but we may observe also, how the viscera of the pelvis, being more firmly connected by cellular membrane and constricting muscles, support the weight of the abdominal viscera; that, by the combined power of the perineal muscles, levator ani, coccygeus, and iliacus internus muscles (the antagonists of the abdominal muscles and diaphragm), the prolapsus of the parts is prevented; yet we can conceive in the female pelvis a hernia of some of the intestines, betwixt the vagina and rectum, forming a tumor pushing down from the vagina; or here sometimes a hernia may insinuate itself betwixt the bladder and os pubis getting access to the thyroid hole; nay, there are even instances of hernia protruding upon the hip from the sacro-ischiadic hole.

VIEW OF THE PELVIS FROM BEHIND; BEING AT THE SAME TIME A RECAPITULATION OF THE PRECEDING VIEWS OF THE PARTS.

EXPLANATION OF PLATE XI. FIG. 2.

In this subject, after a minute injection of the pelvis, the os sacrum was taken away; the rectum also was dissected away, that the bladder might be seen from behind, and a more comprehensive view allowed of the distribution of the INTERNAL ILIAC ARTERY. The branching of the arteries here are not what will be considered as regular; but it is better to take such natural distribution, though not perfectly regular, and draw accurately, while the more general division of the branches are thrown into a scheme.

- A A, OSSA ILIA.
- B, ACETABULUM.
- C, TUBEROSITY of the OS ISCHIIUM.
- D, The BLADDER of urine distended.
- E, The URETERS.
- F, The BULB of the urethra.
- G, The PROSTATE GLAND.
- H, The MEMBRANOUS PART of the URETHRA.
- I, The VAS DEFERENS.
- K, The VESICULÆ SEMINALES, as they appear in a boy when injected with mercury.

ARTERIES.

1. The AORTA ; the rectum having been dissected out from betwixt it and the bladder.
 2. The COMMON ILIAC ARTERIES.
 3. The EXTERNAL ILIAC ARTERY going to the thigh.
 4. The INTERNAL ILIAC OR HYPOGASTRIC ARTERY.
 5. The ILIO-LUMBAR ARTERY.
 6. The HYPOGASTRIC ARTERY, or umbilical artery of the foetus, pervious now only so far as to supply arteries to the bladder.
 7. The PUDIC ARTERY (OR EXTERNAL HEMORRHOIDAL) coming off in the same trunk with the last.
 8. The THYROID ARTERY.
 9. A branch from the thyroid artery penetrating the bone.
 10. A trunk common to the GLUTEAL and ISCHIADIC ARTERIES.
 11. The GLUTEAL ARTERY, OR ILIACA POSTERIOR, where it comes out from the pelvis, branching largely on the back part of the os ilium.
 12. The ISCHIADIC ARTERY.
- To demonstrate these two last arteries is an important dissection, which will be more dwelt upon in that part which contains the dissections of the thigh.
13. A branch going to the gluteal muscles and great sciadic nerve, and from which one of the lateral sacral arteries goes off.
 14. A branch from the umbilical artery to the bladder, anastomosing with others upon the upper part of the bladder.
 15. VESICALIS IMA.
 16. SACRÆ LATTERALES cut short.
- BRANCHES OF THE PUDICA COMMUNIS IN THE PERINEUM.
17. DEEP SEATED BRANCH of the PERINEAL ARTERY.
 18. SUPERFICIAL BRANCH OF ARTERIA PERINEI.
 19. HÆMORRHOIDAL VEINS going to the skin and fat about the anus.

SCHEME OF THE ARTERIES OF THE PELVIS.

AORTA.

Sacra media.—ILIACA COMMUNIS.—Lumbalis ima.

Iliaca externa.—ILIACA INTERNA or hypogastrica.

While the external iliac goes down to the thigh, the internal iliac gives off the following branches :

Obturator; which sometimes gives off the ilio-lumbalis.

Iliaca posterior gives off { Sacrae laterales,
Ilio lumbalis, } sometimes.
Obturator, }

Ischiadica; which sometimes gives off the Obturator.

Pudica; giving off { Veficalis ima,
Arteria proftata,
Hæmorrhoidæ media; this frequently from the hypogastrica.
Hæmorrhoidæ externa.
Arteria perinæi—Transversalis perinæi.
Arteria penis.

Umbilicalis; in the female giving off { Arteria uterina.
Ramus ad veficam.
Hæmorrhoidæ media—branching to the { Rectum,
Vagina,
Bladder.

ANOTHER ARRANGEMENT.

Internal iliac.

Gluteal.

Ifchiadic.

Ilio lumbalis, sacro lateralis.

Umbilicalis, pudica, obturator.

SCHEME OF THE ARTERIES OF THE RECTUM.

The superior hæmorrhoidal artery, which is the descending branch of the inferior mesenteric.

The middle hæmorrhoidal, from the pudic artery within the pelvis.

The external hæmorrhoidal, from the pudic artery, where it appears without the pelvis, Plate X. fig. 3. 5.

OF THE DESCENT OF THE TESTICLE; OF THE MANNER OF DISSECTING; AND OF THE DISEASES ILLUSTRATED BY THIS PIECE OF ANATOMY.

The descent of the testicle in the fœtus is, in a physiological light, extremely curious, and almost inexplicable as a piece of anatomy. It is with some difficulty comprehended at first, but worthy of our utmost

attention, as illustrating many important diseases; hernia, hydrocele, and all diseases of the testicle, chord, and abdominal ring.

EXPLANATION OF PLATE XII.

I shall here endeavour to throw together the explanation of the figures and of the method of dissecting. In a recapitulation, I shall point out the circumstances chiefly worthy of investigation, and the complication of the more simple anatomy in hernia, hydrocele, &c.

FIG. 1.—This was a dissection of a foetus of seven months; at which time, in general, the testicle will be found adhering just without the ring, as was the case in the other groin of this subject. The angular flap of the abdominal muscles of the right side being laid down over the thigh, the intestines removed, and the ring of the abdominal muscles dissected, the parts appear thus:

A, The BLADDER pulled aside by a ligature upon the umbilical arteries.

B, The UMBILICAL OR HYOGASTRIC ARTERY of the right side.

C, The RECTUM. Both the bladder and rectum, it may be observed, stand high and almost out of the pelvis, the whole contents of the pelvis falling lower in the adult.

D, The PENIS.

E, The SCROTUM as yet without the testicle.

F F, The ABDOMINAL MUSCLES.

G, The BODY of the TESTICLE.

H, The EPIDIDYMIS. The testicle is here approaching the ring; having descended from its pristine situation immediately below the kidney and upon the psoas muscle.

I, The SPERMATIC ARTERIES and VEINS, and (as may be seen in fig. 2.) without either the vas deferens or the cremaster muscle.

K, The GUBERNACULUM TESTIS covered by the peritoneum.

L, The PERITONEUM, dissected off the abdominal muscles F F.

M, The PROCESS of the PERITONEUM, which, being prolonged through the ring of the abdominal muscles, is lost among the cellular substance in the groin N.

I hope it will be sufficiently understood how the testicle G is said to be without the peritoneum, *i. e.* behind it; for it lies at present in the same circumstances with regard to it as the rectum.—C, the peritoneum, being stretched over its fore part, and adhering to its substance, forming the TUNICA ALBUGINEA. The testicle still continuing its descent, by the shortening of the Gubernaculum K (see more distinctly fig. 2.); and the inflexions of the peritoneum still retaining their relation to the testicle, it falls gradually into the sac N, which becomes thus a second coat to the testicle, the VAGINAL COAT. As the surface of the peritoneum retains its lubricating secretion, these two coats do not adhere, but the outer or vaginal coat simply embraces without adhering to the innermost or tunica albuginea. It will be at once understood, that this is a delicate piece of dissection.

EXPLANATION OF FIG. 2.

The second figure is a further dissection of the same parts.

A, The BLADDER.

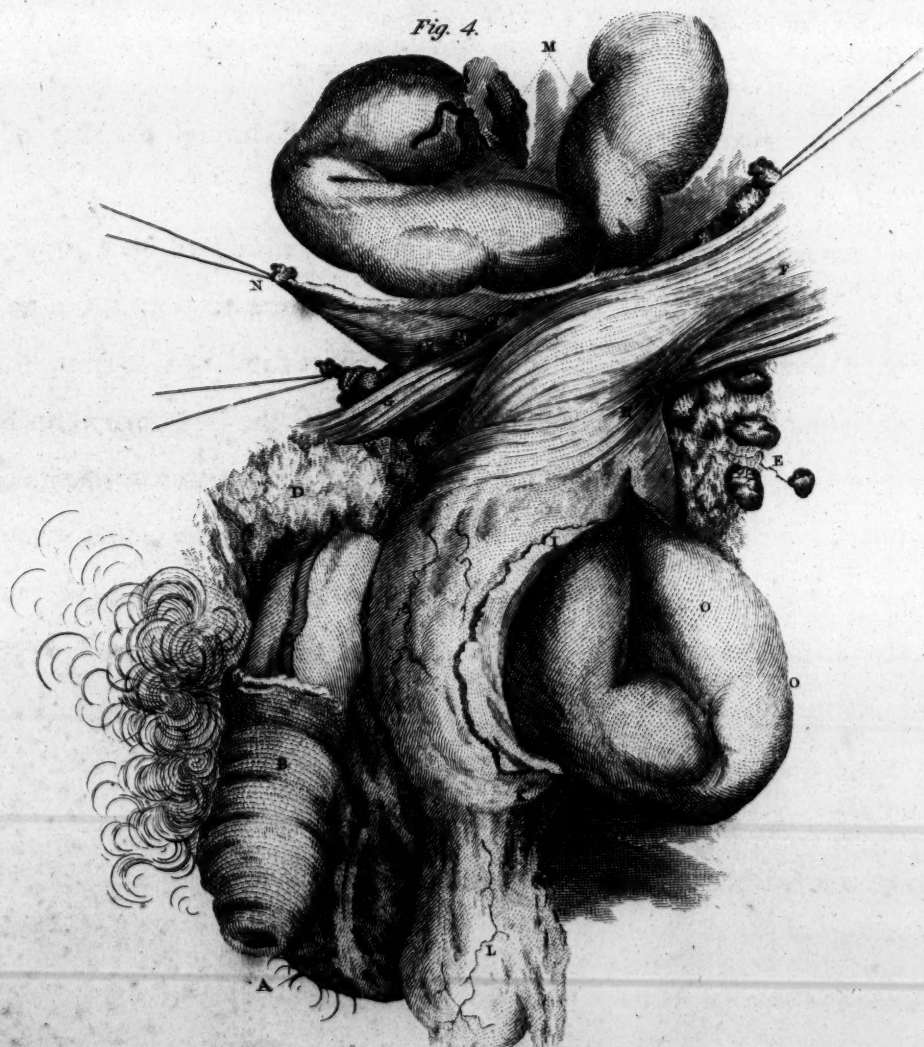
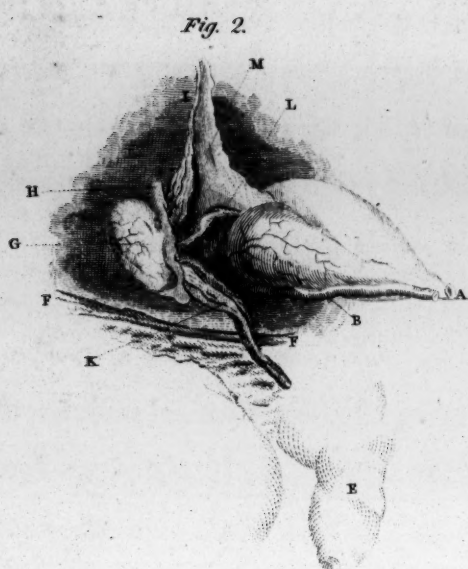
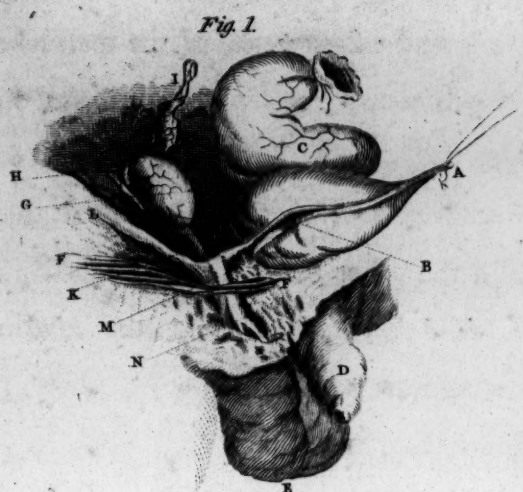
B, The UMBILICAL ARTERY.

E, The PENIS.

F, The ABDOMINAL MUSCLES laid down over the haunch, and dissected of the peritoneum.

G, The TESTICLE.

H, The EPIDIDYMIS, still covered by the peritoneum; it being impossible to dissect it off.





I, The SPERMATIC ARTERIES and VEINS coming down to the testicle, and divested of their peritoneal covering.

K, The GUBERNACULUM TESTIS, with the peritoneum dissected off in its whole length. This is considered as of a ligamentous nature, but has no appearance of a ligament; it is seen much crowded with vessels after a minute injection, and its fibres are apparently muscular. It is impossible to demonstrate here how the cremaster muscle is reflected upon it.

L, The VAS DEFERENS, seen going down behind the bladder, and betwixt it and the peritoneum.

M, The PERITONEUM dissected back from part of the bladder, and from the vessels of the testicle, showing how they lie behind that membrane.

EXPLANATION OF FIG 3.

In the third figure we have a view of these parts after the full descent of the testicle; but the parts still retain their original features. To lay open this view, the parts were dissected thus: The peritoneum was raised from the inner side of the abdominal muscles; the process of the peritoneum (Q), which stretches down through the ring, forming the two coats of the testicle (like the pericardium upon the heart), was still open; or, in other words, you could insinuate a probe from the cavity of the abdomen, down betwixt the tunica vaginalis (Q) and the tunica albuginea (P). This process of the peritoneum, then, being gently stuffed with cotton, the parts were put into spirits to harden. After a few days the dissection was resumed. The vaginal coat (Q) was cut, showing the testicle (P) lying on the back part, as in congenital hernia or hydrocele, and covered by the tunica albuginea; that is, as it lies in fig. 1. G, covered by a single layer of the peritoneum. The peritoneum was then dissected off the loins, and folded over towards the bladder (G H), in order to show how the spermatic vessels, nerves, and vas deferens, run down behind the peritoneum until they gain the testicle.

A, The BLADDER pulled aside.

B, The TWO UMBILICAL OR HYPOGASTRIC ARTERIES cut across.

C, The RECTUM.

D, The SCROTUM.

E, The PENIS.

F, The THIGH.

G H, A portion of the PERITONEUM, which covered the spermatic vessels, held aside.

I, The URETER going down by the side of the rectum.

K, The COMMON ILIAC before giving off the hypogastric B.

L, The ANTERIOR CRURAL NERVE; twigs are seen going to the groin and spermatic chord.

M, The FEMORAL VEIN.

N, The SPERMATIC ARTERIES and VEINS, going down to the testicle behind the peritoneum.

O, The VAS DEFERENS; where it turns over to descend to the vesiculæ feminales.

P, The TESTICLE covered only by the tunica albuginea.

Q, The TUNICA VAGINALIS slit up, and seen communicating with the cavity of the belly.

THE COATS OF THE TESTICLE OF THE ADULT, AND SOME OF ITS DISEASES ILLUSTRATED FROM THE ANATOMY OF THE TESTICLE IN THE FOETUS.

CAUSE OF THE DESCENT OF THE TESTICLE.—It is utterly impossible to account for the descent of the testicle by any mechanical action, by the pressure of the abdominal muscles, by the peristaltic motion of the intestines, by the generation of wind in them, or by gravitation:—for the foetus lies in the womb with

the head downwards, the abdominal muscles are quiescent, and the probability of occasional inflation in the intestines of the foetus is very small. Besides, any general pressure would, at all events, more probably act upon some of the looser viscera, and produce rather a hernia than the regular descent of the testicle.

The action of the gubernaculum (K, fig. 1. and 2.) is the more natural explanation. It guides the testicle into its destined lodgment, and probably solicits it by a gentle action. Yet this action is unlike the action of other muscles, being unremitting whilst the testicle is within the belly; and when the testicle is arrived without the groin, a relaxation must take place, allowing the testicle to descend into the scrotum. It is worthy of remark, that neither the spermatic vessels (I) nor the vas deferens (L, fig. 1. and 2.) appear as if elongated or stretched, but retain their peculiar tortuous waving figure. Under the title of GUBERNACULUM TESTIS, the fibres of the future cremaster muscle are included; and perhaps this muscle has the chief action in bringing down the testicle. The fibres of this muscle are with difficulty demonstrated in the human foetus; but from comparative anatomy, it is found that it is reflected from its origin from the transversalis abdominis upwards, following the gubernaculum. In this situation of the parts in the foetus, the cremaster muscle must lie behind the peritoneum; but in the adult, as that side of the peritoneum, which is contiguous to the psoas muscle, becomes in the scrotum the outer surface of the peritoneum which covers the chord, the cremaster becomes an outward layer of fibres embracing the chord. The exit of the testicle through the abdominal ring is certainly facilitated by the gubernaculum as a precursor. It altogether forms a body of a wedge shape or pyramidal form (its base being upon the testicle) which must gradually dilate and fill up the abdominal ring. When the testicle is as yet far up upon the loins, the gubernaculum is slender; by its contraction it becomes thicker; and before the testicle has arrived at the outlet, it scarcely forms a larger body than the contracted and thickened gubernaculum which has preceded it.

SITUATION OF THE TESTICLE IN ITS FULL DESCENT.—As the testicle descends, the process of the peritoneum accompanying it changes by insensible degrees. Though we see in a child upon one side the testicle lying behind the peritoneum like the other viscera of the abdomen, yet upon the other side, if the testicle have fully descended, we shall have some difficulty (from the additional layers of cellular membrane it has acquired) in dissecting the vessels (N, fig. 3.) from the peritoneum (H), to show that the vessels run down behind the sac to supply the testicle. Shortly after the descent, the prolonged sac of the peritoneum coalesces and surrounds the spermatic chord, now composed of the spermatic vessels (I, fig. 2.) the vas deferens (L), and the muscular fibres (K). These form one mesh;—so that no passage remains pervious from the cavity of the abdomen down betwixt the tunica vaginalis (Q) and the tunica albuginea (P). Mr. Hunter was of opinion, that in those cases where the testicles remain in the belly, the testicles are diminutive, and more imperfect than those which descend into the scrotum. But the smallness of the testicle may as probably be the consequence of its remaining in the belly as the cause of its delay; and the testicle may require to descend into the scrotum to receive its perfect action and tone.

OF CONGENITAL HERNIA.—How widely different the causes of the descent of the testicle are from those of a rupture, appears from the rarity of the occurrence of the congenital hernia, or the passing down of a portion of the intestine along with the testicle. This is very remarkable, when we consider that a turn of the intestine is not larger than the testicle to which it lies contiguous, and that the testicle remains long in the very ring dilating it; yet by the peculiar mechanism and interlacing of the fibres of the ring, the intestine is not allowed to follow. Indeed, many are of the opinion of the celebrated Wrisberg, that the congenital hernia does not happen but by a previous adhesion of some of the intestines to the body of the

testicle, by which it is drawn down alongst with it. Wrisberg found the ring, in several instances, so wide, and the parts so lax, as easily to allow the descent of a portion of the gut or omentum; yet in these cases there was no hernia. Again, he found in other young subjects, where the testicle still remained in the belly, that it had contracted adhesions with the omentum. And, lastly, he found in a case of old congenital hernia (upon opening the belly), that a portion of the omentum seemed to be attached to the ring; but, upon further dissection, he found it continued down through the ring, and adhering to the tunica albuginea of the testicle. In other cases, he found the testicle so connected with the intestinum caecum, that in pulling the one either way, the other followed. And, what he conceives to be a convincing proof, he found in one side of a subject a fasciculus of fibres attached to the testicle, and inclosed in a duplicature of the peritoneum; while, on the other side, though the ring was so wide as to allow the finger to slip in, there was no hernia. From these facts, he conjectures that the congenital hernia is, for the most part, formed in consequence of adhesions betwixt the testicle and viscera; and that the intestines, or omentum, are, in consequence, drawn down alongst with the testicle. It is a curious circumstance, if fully proved, that the testicle not only most unaccountably comes down into the scrotum, but that its tendency thither is so great as to pull down the intestine, and elongate the mesentery also.

It would be an idle repetition to point out the method of dissecting and investigating the congenital hernia, since the circumstances of its anatomy, and its character and peculiarities, have been already detailed. The appearance of the more common rupture may perhaps be more opportunely illustrated here.

OF INGUINAL HERNIA.—Although the abdominal ring be preternaturally wide, if the testicle shall have descended naturally, and the peritoneal sheath be closed, hernia congenita is for ever prevented; but if, upon any unusual exertion, a portion of the intestine shall be forced through the ring, the old sheath is not opened, but a new sac of the peritoneum is forced down; and though it take the same course with the testicle, it still, in all its stages, remains detached and in a distinct process of the prolonged peritoneum.

OF THE METHOD OF DISSECTING HERNIA.—To explain the appearances of the abdominal ring and sac, I shall follow the method by which I gained my information, trusting that I shall always be simple and intelligible in the description, while the idea is correctly fixed in my own mind.

In an old case of hernia, and where the patient's death has not been occasioned by the rupture, the ring is wide, the intestine loose in its sac, and the testicle lax, hanging far down, and often much wasted. Upon laying open the integuments, the peritoneal sac of the hernia comes into view; and when the chord and testicle are extricated in their full length, the preternatural sac has no marked limits, but seems gradually to coalesce with the chord, being enveloped in loose cellular membrane and adventitious vessels. Upon dissecting up towards the abdomen, we find no ring, but the sac of the hernia gradually blended with the tendon of the external oblique muscle (Plate XII. fig. 4.); which, stretching over the neck of the sac, is so closely mingled with it, that it is only distinguishable from it by the whiteness of its encircling fibres. To demonstrate further this preternatural connection, we lay open the belly, and examine the state of the viscera and the portion of gut protruded; we dissect carefully the peritoneum (N) round the ring from the muscles, showing how it forms a sac inclosing the hernia: then we show the spermatic chord going down quite on the outside and behind this sac, and lay open the vaginal coat of the testicle, showing that the testicle lies distinct in its appropriated coats: and lastly, show the hernial sac distinct from the spermatic chord or coats of the testicle.

APPEARANCES OF INCARCERATED HERNIA.—In a strangulated hernia, where it has been the immediate cause of death, though the essential circumstances of the anatomy remain the same, the occasional occurrences are infinitely varied. Upon making an incision to lay bare the sac, it is found tense and firm,

crowded with vessels, and thickened towards the ring; the marks of inflammation are greater: perhaps externally the cause of strangulation appears in the inflammation of the surrounding membrane, and disease and suppuration of some of the lymphatic glands. But in the more recent and smaller herniæ, as those more frequent under Poupart's ligament in women, the danger is greater and more pressing. In such cases, in the stage of the dissection which we are now considering, the inflammation is extensive; the cellular membrane is caked and hard. In the femoral hernia we have to dissect and expose the fascia of the thigh; the coat of fibres which surround the proper peritoneal sac of the hernia; and chiefly, to show its relation to the ring, the spermatic chord and epigastric artery (See the outline, Plate I. fig. 2. and Plate XIV. fig. 1. and 2.).

But to return to the inguinal hernia. Upon opening the belly, the intestines are found inflamed and distended. If the hernia has been large, the mesentery is elongated by the pulling of the intestines, and the viscera in much disorder, even the stomach having descended from its place; so that sometimes in old herniæ the abdomen is left almost empty of the floating viscera. In a case where the intestines have been reduced either by the operation or taxis, the reduced portions are found lying within the ring adhering; often sphacelated. Upon laying open the sac of the hernia (if of old standing), it is found to consist of many layers, smooth as the abdominal peritoneum within, including most commonly the omentum, or a portion of the ilion in the sac. If the omentum have fallen down, it will have altered much of its nature, become firm and condensed, composed of hard pellicles of fat irregularly connected by membranes; with frequent strings of adhesion, tortuous dilated veins, and general inflammation. If the strangulation of the gut have advanced far, then it is dark and mortified, with foul serum in the sac: adhesions are frequent betwixt the doublings of the gut, very rare between the gut and sac. It would appear to me that the irregularity of the functions of the intestinal canal, the inflation or congestion in the protruded portion of gut, is the more frequent cause of strangulation, and of the worst symptoms, in old hernia; and that the inflammation and constriction of the neck of the sac is secondary merely. Sure I am, that the intestine is seldom reduced by the mechanical exertion; but merely the flatus in the intestine is forced into the intestines within the belly, and then the portion which had descended is drawn in by the action of the intestinal canal: and, again, it would appear, that frequently in attempting the reduction, the mouth of the sac is pushed aside from the ring, and the reduction prevented.

When the incarcerated portion of the gut gangrenes and sloughs off, the fascia, cellular membrane, and glands of the groin, form one confused foetid mass, and all that can be done is to lay it freely open, and leave it to nature. The upper part of the canal being opened, the load is evacuated by this artificial anus. The patient has sometimes survived; discharging the fæces by the groin. But it is a more curious resource of nature, by which the fæces resume their natural course in the rectum, although a complete convulsion of the gut has been cut off. This is accomplished by the two ends of the intestines, strictly included in the ring, or under the femoral ligament, forming an adhesion and communication with each other; which is completed by the closing of the anus in the groin. This is more frequent in the small femoral hernia of women.

EXPLANATION OF PLATE XII. FIG. 4. SHOWING THE STATE OF THE RING IN HERNIA.

This figure fully illustrates the more important points in this piece of morbid anatomy.

A, The SCROTUM of the left side laid open.

B, The PENIS.

C, VENA IPSIUS PENIS.

D, Mass of fat upon the pubis, which restrains the erection of the penis.

E, INGUINAL GLANDS and FAT.

F, TENDON of the EXTERNAL OBLIQUE muscle.

- G, The insertion of the two pillars of the ring into the os pubis.
- H, Marks the fibres of the TENDON running in diverging circles, as if carried down by the protrusion of the sac.
- I, The SAC laid open to show the gut.
- K, The bottom of the sac.
- L, The TESTICLE considerably diminished.
- M, The GUT seen within the belly.
- N, The PERITONEUM held out by a thread, having been dissected from the abdominal muscles.
- O, The PORTION of the GUT included in the hernia.
- N. B. The relative situation of the parts in the femoral hernia will be fully illustrated in treating of the vessels of the thigh.

OF HYDROCELE.—As in the last species of hernia the intestines take a new rout, and are preceded by a distinct sac of the peritoneum; so in hydrocele, the tunica vaginalis testis being distended with fluid, the original sheath (Q, fig. 3.) is not again opened, but that part which envelopes the chord (now degenerated into loose irregular cellular membrane) remains entire, while the distended sac swells on all sides, but chiefly upwards, and before the spermatic vessels conically. So that, upon laying open the sac in the operation for the radical cure, the testicle is seen covered only by its proper tunica albuginea, unless when, by frequent tapping, a partial inflammation has been communicated to the testicle; in which case, it very commonly adheres to the fore-part of the tunica vaginalis which had been punctured with the trocar. To demonstrate the anatomy of an advanced hydrocele, we inject the spermatic vessels, follow the chord down behind the sac formed by the dilated vaginal coat, fill the sac, by a small puncture, with spirits, and harden the whole in spirits for a few days;—then opening the vaginal coat, to show the situation of the testicle, the preparation is preserved in spirits.

The diseases of the spermatic chord show us how completely it is changed in its nature from that of the peritoneum; for its cellular structure sometimes becomes the seat of dropical swelling, forming a species of hydrocele:—sometimes it appears like a collection of hydatids, yet neither communicating with the vaginal coat of the testicle nor with the cavity of the abdomen:—sometimes the hydrocele consists of only one or two vesicles; and when the lower portion of the chord is pressed, the swelling subsides, and retires to the cells in the chord within the abdomen. Knowing how peculiarly liable such a congeries of veins as that which forms the spermatic chord is to disease, we cannot wonder to find the tortuous veins of the testicle so subject to varicose enlargement and all its consequences.

OF THE INVESTIGATION OF DISEASE IN THE PELVIS, AND OF THE MORBID STATE OF THE PARTS.

In their diseased state, the parts in the pelvis should not be cut out hastily, or before attention be paid to such points as can alone be illustrated by an examination of the parts in situ. After the great operations, the spreading of inflammation to the bowels, the stage to which the inflammation has proceeded, the quantity of matter, and the course of sinuses near the wound, should be observed:—then the parts being carefully washed, and the vessels perhaps injected (if the state of the subject will allow it, and if they be of consequence in the dissection, as after lithotomy), a freer investigation may be allowed.

For example, in a case of lithotomy, we have to observe the state of the intestines. If the patient has died soon after the operation, the degree of inflammation amongst the intestines, and their distention; if the patient has lingered and died debilitated, the inflammation will have subsided, and there will be adhesions amongst the intestines, inflation, and in all likelihood scybulae; the lower portion of the colon, at least will be distorted and inflated, forming preternatural adhesions. We have to observe the direction of the incision; the state of the wound; the sinuses, that too often stretch up from it by the side of the rectum, and the effects of which will generally be seen upon the peritoneum, by folding back the rectum from the sacrum.

In dissection, after puncturing the bladder, or after a tedious case perhaps of retention of urine where the catheter has been used, the instruments should be allowed to remain: Then the bladder being opened from above, we can observe their true place, see them projecting into its cavity, judge of their effects, and of the inflammation in consequence, and of their pressure and effects on the neighbouring parts or opposite coats of the bladder. In taking out the parts, the penis should be first separated from the pubes (which, by the by, may be done without leaving any apparent deficiency, by leaving the skin and glans), the crura cut from the bone, and the whole forced down under the arch of the os pubis: Then proceeding to the inside, cut all freely out, by carrying the knife close to the bones of the pelvis; by which all the parts are retained for further investigation in their natural connections.

How much more important does it make a preparation, to see the kidney diseased, stones impacted in its substance, or abscesses excavating it, the dilated tortuous ureters, the contracted and thickened bladder with the stone in its cavity, or the diseased prostate gland, and constricted urethra, all connected and illustrating each other,—than if each of these were detached and in separate glasses? If students would learn to value a museum, not by the numbers of the glasses and magnitude of the collection, but by the elegance, cleanliness, and useful inferences to be drawn from preparations of morbid parts, or the important points in anatomy which are illustrated by the others, teachers would become ashamed of their opportunities thrown away, and merit would attach to those who had made the best use of their situation.

OF THE BLADDER.—Although in the great dilatation of the bladder from retention of urine, there is, in general, no apparent change in the coats; yet, in some instances, the inner membrane has been found loaded and black with extravasated blood. Where rupture has taken place, the gangrene is of small extent, and circumscribed. In cases of stone, cancer, and tumors, in the bladder, it is generally thickened (probably by continued irritation), and the inner membrane, if not evidently inflamed, is covered with an adhesive slimy matter. In such as die violent deaths, and in some fevers, the bladder is said to be found in a state of very strong contraction.

In obstruction of urine, the bladder suffers astonishing dilatation; it does not burst, but becomes gangrenous; a small spot in its fundus shall mortify and give way, and the urine escape amongst the viscera. When the bladder has suffered long distention, although the urethra be not obstructed, the bladder shall have lost its tone, the urine shall drop from the penis, but the patient is in the same danger of gangrene if the waters are not drawn off.

The most common effect of disease, as of a stone, ulcer, or fungous excrescence, in the bladder, is the thickening of the coats, sometimes even to half an inch in thickness. But this, if we examine narrowly, cannot be mistaken for an increase of muscular force, in order to overcome the difficulty of expelling the urine. The bladder, in this state, becomes thickened, but at the same time inert. It gives great resistance to distention, but its contraction is also limited: The urine is expelled frequently, and in small quantity, but never completely evacuated.

The inner surface of the bladder is, in some cases, diseased with fungous or polypous excrescences; sometimes there are small irregular tubercles upon its whole inside; and not uncommonly such tumors

externally, they may be mistaken for the prolapsus of the womb: for this latter is not always a regular tumor, with the projecting os tinæ distinctly to be recognized; but, on the contrary, it is frequently very irregular and distorted, the orifice of the womb turned aside, the vagina firmly adhering. Even in dissection, sometimes it is impossible to unravel the adhesions; and it is only known to be a prolapsus of the womb from the change in the viscera, and the sinking downwards of the fundus uteri betwixt the rectum and bladder. During life, it is known by the stilicidium, or by the periodical discharge from the orifice of the womb. The prolapsus uteri is often preceded and occasioned by a diseased state of the uterus itself; or it is likely that a dormant disease of this viscus may be excited by the escape from pressure, by the exposure of a secreting surface to air, and the attrition to which the parts are liable; and a terrible ulcerated fungous mass is formed, taking away all semblance of the original form of the parts.

As of some consequence in the examination of these diseases in the living body, it may be observed, that when examining either in ano or within the vagina, the tumors or diseased parts may not come within the touch without changing the posture of the patient, placing her in an erect posture, or in that of going to stool, and causing her to make an effort; by these means only, the uterus, or tumors, or polypi, can be brought downwards within the reach.

Of all the parts of the female pelvis, the ovaria are the most frequently diseased. But in reference to practice, the knowledge of them is unimportant; except in cases of dropfy, which are extremely frequent.

The changes of the ovaria can scarcely be considered as disease: in old age they shrink and become diminished in size; sometimes they become solid; they become more distinctly vesicular and enlarged, and full of a yellow turbid fluid; they become a congeries of small hydatids:—These diseases advancing, they become scirrhus, enlarged and firm, containing a steatomatous cheesy matter, or distinct sacs of fluid. In consequence of disease following impregnation (an imperfect impregnation is very improbable), we find fatty and strangely condensed matter; or, in some rare instances, hair matted and condensed; and even teeth growing and fixed as in a socket, and with a completely formed enamel, as if the pulp and membranes of the teeth had been engrafted, and taken a communication of vessels from the ovum, then grown to full maturity. In the dropfy of the ovaria, they sometimes swell to immense size, filling the whole belly. The encysted dropfy of the ovarium, when it has proceeded thus far, can only be distinguished from the history of the case. The swelling is in the beginning distinct, insulated, and moveable, and situated to one side, answering to the seat of the ovarium. It gradually dilates till it comes in contact with the peritoneum of the abdominal muscles, adheres to it, stretches up to the diaphragm, forms adhesions with its lower surface, and throws back and compresses the intestines without adhering to them. From the more glutinous nature of the fluids, in the encysted dropfy of the ovarium, it will generally require a larger trochar than the ascites abdominalis.

To give a full and comprehensive view of the diseases incident to the female pelvis would lead to a very long discussion. It would comprehend appearances infinitely varied, especially in the impregnated state. The diseases of the uterus, placenta, and chord; of the ovum in all its stages, and particularly the abortion of the first months, with their multiplicity of deranged appearances, are difficult to be understood; and the explanation of them requires a complete knowledge of a very delicate and minute piece of anatomy, together with much practical dexterity. It is indeed a subject so extensive, that it cannot be fully treated of on the present occasion.

In treating of the morbid anatomy, I have endeavoured to avoid the appearance of attention to minutiae where nothing is understood, or where I could give no information; sensible that such an attempt fills the eye only, and becomes a mere catalogue of diseases. But I have attempted to place this part of my subject upon the wider basis of the mechanical action of the parts or general consequences, extensively applicable, as depending upon the laws of the economy.

DIRECTIONS FOR THE BINDER.

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A
S Y S T E M
OF
D I S S E C T I O N S.

P A R T IV.

CONTAINING

DISSECTION OF THE FASCIA AND SUPERFICIAL PARTS
ON THE FORE PART OF THE THIGH ;
DISEASES OF THE CUTANEOUS VEINS, LYMPHATICS,
AND FASCIA ;
OF THE LIGAMENT OF THE THIGH AND FEMORAL
ARTERY IN THE GROIN ;

TUMORS IN THE GROIN ;
FURTHER DISSECTION OF THE ARTERIES AND NERVES
OF THE THIGH ;
ACCIDENTS AND DISEASES OF THE ARTERIES OF THE
THIGH ;
OF THE POPLITEAL ANEURISM ;

OF THE CHANGES WHICH TAKE PLACE IN THE CAPACITY AND ACTION OF ARTERIES ;
AND OF THE CIRCUMSTANCES WHICH INFLUENCE THOSE CHANGES.

WITH PLATES.

SECOND EDITION.

BY CHARLES BELL, SURGEON.

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1800.



A

S Y S T E M

OF

D I S S E C T I O N S.

DISSECTIONS OF THE THIGH.

Remarks introductory to the Dissection of the Extremities; the Effects of the Muscles and Fascia upon the Vessels; and the Peculiarities in the Distribution of the Veins and Arteries.

IN the dissection of the thigh, the method of investigation, as well as the object of it, is essentially different from that which is followed in the dissections of the belly and thorax. We find the limbs made up of a solid muscular flesh, which surrounds the bones, gives symmetry and action to the limbs, and poises the trunk upon them: and, besides the integuments common to every part of the body, we find them covered with strong fascia or the aponeurotic extension of prolonged tendons; which not only supports and braces the muscles in their action, but gives the limbs a defensive strength, by forming them into a firm concentrated pillar.

The fibres of the fascia, too, mingling with the common cellular membrane, dive amongst the deeper muscles, and divide and class them into fasciculi, having similar powers and simultaneous action. We find the arteries branching amongst the muscles, and exposed, we might at first suppose, to be interrupted in their actions amongst those active and contractile parts; but these arteries have energy and force to overcome or resist the contraction of the muscles of the limbs. The more languid flow of blood in the veins is indeed left exposed to casual interruption by compression of the muscles; but this pressure upon the veins is counteracted, or its bad effects avoided, by their peculiar distribution. In the legs and arms, and in the neck and all fleshy parts, there are two sets of veins: the *venæ comites*, accompanying the arteries through their whole course amongst the muscles; and the cutaneous veins, which, though like the others they receive the returning blood from the arteries, take a different course to the heart, emerge from the oppression of the muscles, and return their blood by a superficial distribution to the heart. We observe no such variety of distribution in the chest or belly—no valves to counteract the retrograde impulse of the blood; because in these cavities there is no occasional and partial action of parts by which the return of the blood can be retarded, the pressure being uniform through the whole cavity—and because, from this uniform pressure, no distribution of the veins could free them.

When any pressure is made upon the upper part of the thigh, if the pregnant uterus, for example, should press upon the vessels of the pelvis, or a schirrous tumor should arise from the glands of the groin

surrounding the crural vessels, the veins are the first to suffer; the supply of blood is not diminished, but the free return of the blood is retarded, causing œdema: and in the case of an adventitious tumor, though both arteries and veins pass through it, the arteries, by the strength of their pulsation, remain free, and possessed of full room for action, however large the tumor; while the veins, being more passive, having no action, are encroached upon by the tumor, and compressed, and the blood made to stagnate in their dilated extremities.

We learn from this the importance of making the pressure uniform over all the lower part of the limb, when we apply bandages or compress an artery. Were it possible so uniformly to compress a limb, from the toes to the top of the thigh, as to leave no part uninclosed or unsupported (unless in inflammation of the parts), almost any degree of compression might be used; for in that case the blood would flow uniformly over the whole limb; and though stifled in a degree, no part would be overloaded with blood.

Further peculiarities in the anatomy of the extremities will naturally come to be noticed in the course of the history of each dissection.

FIRST DISSECTION OF THE THIGH.

Of the Fascia of the Thigh, the Inguinal Glands and Superficial Vessels, the Lymphatics and Cutaneous Nerves.

IN acquiring a knowledge of the economy of the body, of the peculiarities in the distribution of the vessels of the extremities, of the use and effect of the fascia, and of the characteristic difference betwixt the limbs and the cavities of the trunk and head, this forms an important dissection. With a view to surgery, it is no less important; since a knowledge of the points of anatomy, which it includes, is extensively applicable to practice. It is almost impossible, by description alone, to give such an idea of the appearance of the vessels and membranes, as to enable any one readily to distinguish them in the dissection; yet much assistance may be given, and the character of the parts may be so pointed out, that, when once seen, the recollection will not be quickly effaced.

PRECAUTIONS NECESSARY IN CONDUCTING THE DISSECTION.

IN laying open the integuments of the FORE PART of the THIGH, we should not cut too deep, nor look for the smooth and strong fascia, which, from description, we may naturally have been led to expect; for upon the fore part, and above the tract of the important vessels, the fascia is of a loose and cellular texture; and the gradual change which it undergoes is to be observed only by tracing it from its stronger expansion on the outer part of the thigh.

The true skin only should be dissected back, leaving much of the subjacent cellular membrane. The parts which then come into view may here, as a general instance, be marked.

The LYMPHATIC VESSELS are immediately under the true skin. They are more superficial than the veins and nerves. They run in straight lines, are only partially seen, or are frequently abruptly broken off by the intervening pellicles of fat. They are very large and varicose in appearance, when distended,



in the course of the saphena vein; more numerous upon the middle part of the thigh, and more thinly scattered, but more distinctly seen upon the outer part. In colour and appearance, when in their natural state and collapsed, they resemble loose muscular fibres; being flat reddish lines, most distinctly and strongly muscular in their colour, and pellucid only when distended with air. When these vessels are snipped obliquely with the scissors, or punctured with the lancet and blown up, or injected with mercury, they take a very peculiar appearance; for they swell only betwixt their valves, whilst the valves seem to cut them into beads irregularly joined. But the drawing will be more satisfactory than any description.

LYMPHATIC GLANDS.—At the groin, immediately under the skin, on a level with the lymphatics, and above the fascia and cutaneous veins, we find the congeries of lymphatic glands. But all the inguinal glands are not this superficial; on the contrary, many are sunk amongst the condensed cellular membrane, which, mingled with the aponeurotic membranes, forms a bed covering the femoral artery and vein.

VEINS.—The saphena vein, we are told, lies above the fascia; the great femoral vein below it. This is true; but it must at the same time be understood with some limitation. About six inches from the groin (if merely the skin have been dissected back) we can only see the saphena vein shining faintly through the fascia, even in the leanest subject. It comes up upon the inside of the knee and thigh, and does not dive suddenly under the fascia, but is gradually enveloped, and more firmly embraced, by the fibres of the fascia; which at the fore part of the thigh is split into layers, and so filled with the adipose membrane and fat, that it might be more justly estimated as condensed cellular membrane. Farther down upon the thigh, again, on the inside of the vastus internus muscle, the more natural connection of this vein is with the cellular membrane, being immediately attached to the skin, and having no kind of protection.

NERVES.—Above the fascia of the thigh several delicate and extensively prolonged nerves are seen.

1st, Upon the inner and upper part of the thigh, branching to the scrotum, testicle, and pubes, is the **INGUINAL NERVE**, consisting of delicate twigs, which come by a circuitous course, and are derived by very delicate twigs from the first and second lumbar nerve. Within the belly it may be seen coming out betwixt the psoas and iliacus internus muscles: it winds round part of the spine of the os ilium and inside of the ligament, and pierces the ligament, and appears upon the pubes.

2dly, The **INTERNAL CUTANEOUS NERVE** comes out from Paupart's ligament above the crural vessels, and is largely distributed upon the inside of the thigh, extending its branches round upon the internal condyle of the os femoris and patella. It is a branch of the anterior crural nerve.

3dly, The **MIDDLE CUTANEOUS NERVE***, from the same source with the last, comes out from the point marked by the sartorius muscle, crossing the head of the rectus muscle. It is distributed upon the fore and middle part of the thigh.

4thly, The **EXTERNAL CUTANEOUS NERVE**, derived from the third lumbar nerve, appears upon the outside of the thigh, a little below the lower spinous process of the os ilium; and dividing into branches, one runs round the back and outer part of the thigh, and the other runs down the fascia, where it covers the vastus externus and outside of the rectus muscles.

These vessels and nerves have been mentioned before describing the fascia more particularly; as we must be aware of them in the first cut of the knife, or they are lost to us for ever.

* Some very minute nerves from the deeper branches of the anterior crural nerve join those; but they may be overlooked in the general arrangement.

Were the thigh to be dissected, in order to show the fascia only, I should recommend it to be done first, by laying the fascia bare upon the outer side, where it is strong, and smooth, and tendinous, and where the student can form a confirmed idea of its nature; and then, by dissecting it carefully inwards to the more soft and delicate fore part of the thigh, where the fascia is with difficulty distinguished from the common cellular membrane: I would even leave it there, and begin again to take the skin off from the inside of the thigh, where, although the fascia is not nearly so strong or well defended as on the outside, it is yet more so than in the middle part above the great vessels; and commencing anew from Paupart's ligament, I would dissect downwards over the inguinal glands and vessels. When a knowledge of the parts, and of their appearance, is once thoroughly obtained, it is no longer of consequence how we proceed; but in a first dissection, we are apt to lift membranes, which, being dissected up from within outwards, the whole fascia will inadvertently be dissected off.

EXPLANATION OF PLATE XIII.

In the subject from which this was drawn the parts were lean and extenuated, without any full outline or mass of muscular flesh: and, in order to show the parts for which this figure is intended, the nerves, cutaneous blood-vessels, and lymphatics, such a state of the subject is required.

A, The TENDON of the EXTERNAL OBLIQUE muscle of the abdomen. The manner in which it is tied down by the fascia (C), and the way in which it forms the ligament of the thigh, and is inserted into the os pubis (D), may be observed here.

B, The UPPER SPINOUS PROCESS of the OS ILIUM.

C, Tendinous fibres, communicating betwixt the tendon of the abdominal muscles and the fascia lata.

D, The OS PUBIS, cut very near its symphysis.

E E, CELLULAR MEMBRANE, which, mingling with the fascia in some subjects, almost totally obscures its nature. In this web of cellular membrane, stretching over the great vessels of the thigh, many lymphatic glands are situated F F F; and it is complicated with the cutaneous nerves, veins, and lymphatics.

G, Great origin of the FASCIA LATA of the thigh. At this place it includes in its duplicature the FASCIALIS MUSCLE; which, taking origin from the upper spinous process of the os ilium, spreads down the thigh betwixt the plates of the fascia. The FASCIA, in the direction of the muscle, goes down the outside of the thigh, very strong; and, like a broad tendon, is inserted into the external condyle of the thigh bone.

H, The FASCIA upon the inside of the thigh, where it covers the gracilis muscle. Here it is much thinner, but not so lax as in the middle part of the thigh and in the tract of the great vessels.

I, The origin of the GRACILIS MUSCLE from the os pubis.

K, The VASTUS EXTERNUS MUSCLE.

L, The VASTUS INTERNUS MUSCLE.

M, The RECTUS MUSCLE. These three great muscles are seen shining of a darker colour through the fascia, while the interfices of these muscles are marked by a lighter and more fatty line, like the linea alba and femilunaris of the abdominal muscles. And here, as in the belly, the fascia takes a firmer hold of the cellular membrane below, and sends down fibres betwixt the muscles.

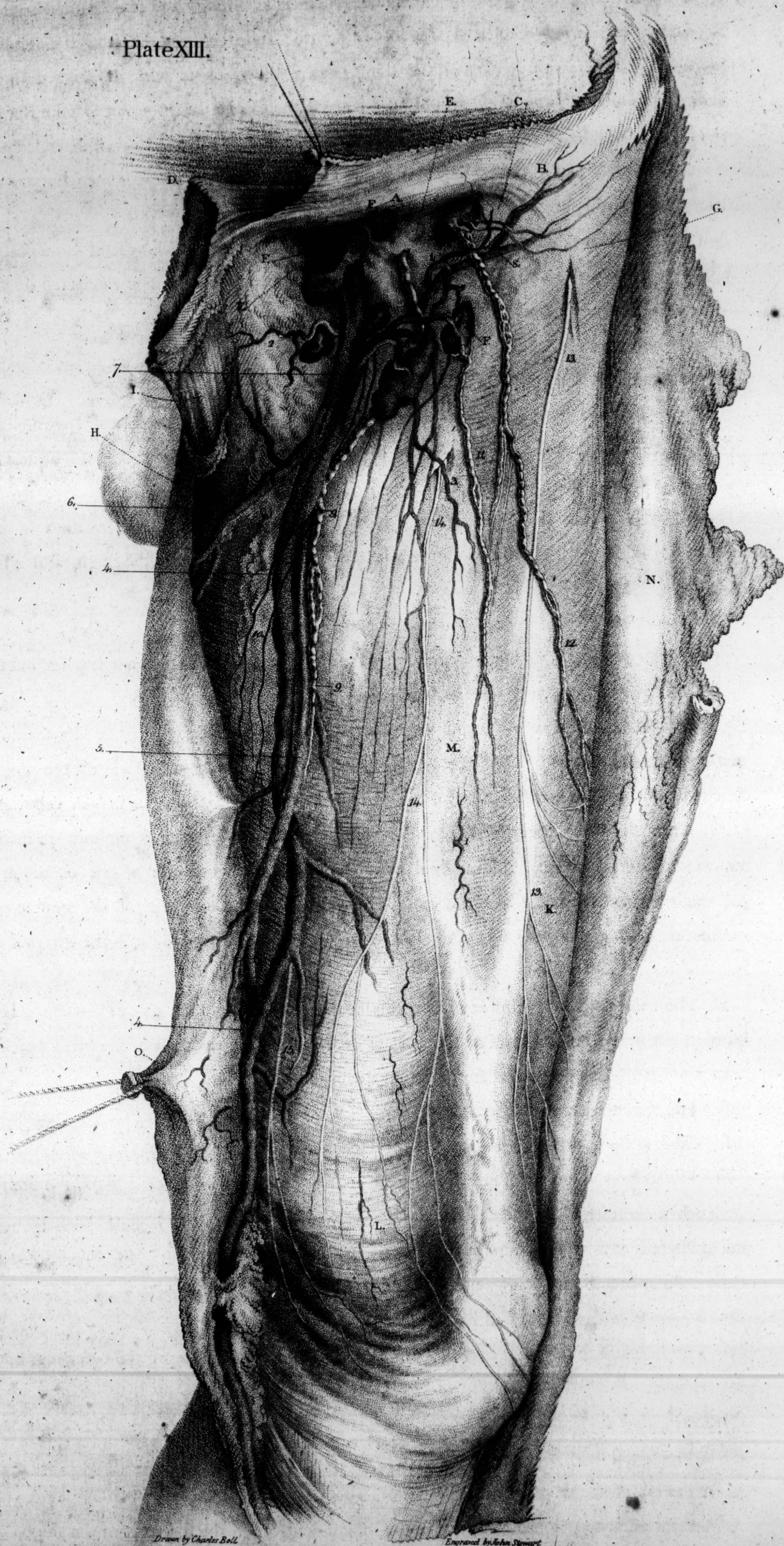
N, The INTEGUMENTS dissected back from the outside of the thigh.

O, The INTEGUMENTS which cover the inside of thigh held out, shewing the cutaneous branches of the vena saphena.

NERVES AND VESSELS.

1. A superficial branch of the femoral artery, supplying the glands, fat, and skin of the groin.
2. A branch of the ARTERIA PUDICA EXTERNA going to the genitals.
3. A third cutaneous branch, supplying the integuments upon the fore part of the thigh.

Plate XIII.



Drawn by Charles Bell

Engraved by John Stewart

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4. The *VENA SAPHENA* in its course on the inside of the thigh ; where it is very superficial, lying betwixt the skin and fascia, and involved in the intermediate cellular membrane.

5. A very considerable branch joining the saphena vein. These are seen a little twisted by the pulling of the skin.

6. Another cutaneous vein coming round from the inside and upper part of the thigh.

7. The trunk of the *SAPHENA VEIN*, before it goes under the fascia to join the great femoral vein. It has been already remarked, that this vein does not plunge suddenly under the fascia, as generally described ; but is gradually encompassed with firmer cellular membrane as it ascends.

8. Branches of veins belonging to the inguinal glands.

9. One of the numerous lymphatics which accompany the saphena vein injected. It appears knotted, or irregularly jointed when inflated or injected.

10. Several of these lymphatics lying collapsed : they appear in general as obscurely reddish lines, parallel and straight in their course.

11, 12. Other lymphatics injected.

13. *EXTERNAL CUTANEOUS NERVE*.

14. *MIDDLE CUTANEOUS NERVE*.

15. *INTERNAL CUTANEOUS NERVE*.

OF THE SUPERFICIAL PARTS SEEN IN THE FIRST DISSECTION OF THE THIGH CONSIDERED AS SUBJECT TO DISEASE.

It has been already explained, that, in treating of morbid anatomy, it is intended, not merely to include the diseased state of the viscera, but also the derangement of the natural anatomy of the extremities and external parts, whether by violence or by disease, with the consequences of their derangement to health and life. In the review of the parts before us now, we have more to observe than might seem strictly to belong to so limited a dissection ; for I shall here consider the diseases of the cutaneous veins, and nerves, and fascia in general.

INFLAMMATION AND DISEASES OF THE CUTANEOUS VEINS.—Although it might have been expected that the ingenious paper of Mr. Hunter, upon the Inflammation of Veins, should have excited general attention, and have been followed up by further observations, we do not find that any progress has been made in their pathology since that time. He pointed out the effect of inflammation upon veins ; shewed, by dissection, how it was propagated alongst their cavities after amputation, bad compound fractures, and extensive abscesses ; proved that matter was sometimes formed in them ; and that, in general, the consequence of the inflammation was to produce partial or interrupted adhesions of their inner coats, preventing the matter from passing into the tide of blood. At the same time, the possibility of matter thus formed mixing with the blood, and being driven to the heart, was explained. “ I have seen (says he), from a wound in the foot, the vena saphena inflamed all up the leg and thigh, nearly as high as the groin ; and “ I have been obliged to open a string of abscesses almost through its whole length.” In other instances, after similar injuries, he found the inner surface of the veins furred over with coagulable lymph*. These observations of Mr. Hunter are given in illustration of the effects produced by accidents in blood-letting, and as establishing a new principle upon which to explain the strange series of symptoms which

* The inner coat of arteries has, in some instances, shewn a degree of inflammation, propagated in a retrograde course to the heart, as after the operation for aneurism.

sometimes take place after bleeding. In this view we shall afterwards have occasion to attend to these facts ; but in the mean time we may proceed to the consideration of other consequences of the injuries of veins.

It has been already explained how the pressure of the uterus, or of an adventitious tumor in the pelvis or groin, may distend the veins of the leg, merely by increasing the resistance to the circulation without any disease or failure in the energy of the coat of the veins. In old people, again, such distension has an evident connection with the general plethora of the venous system, and, in all probability, with a failure of that greater degree of resistance which the veins of the lower extremities should possess, and which is required in them to keep the balance of the system, and counteract the pressure of the column of blood.

But the dilatation of the cutaneous veins is not confined to such cases as these ; for we find that in younger men the veins are often variously diseased ; that sometimes they are varicose, not unfrequently degenerating into tumors, which, amassing the blood, affect the neighbouring parts, and form a dangerous disease. Sometimes, again, influenced by the contiguity of disease, they become tortuous and enlarged round the base of some tumors, or the margin of callous ulcers, forming in many instances their most characteristic feature.

Since we know that the natural capacity of the veins must depend upon the just mean of their resistance to the action of the heart and arteries, we cannot be at a loss to conceive how disease should so weaken the elasticity and power of resistance of their coats as to allow them to dilate ; and (as their dilatation is in length as well as in diameter) to become consequently varicose and tortuous. To illustrate this, let us take the following outlines of a case : A young gentleman, eager in country amusement, was, in scrambling amongst brushwood, pricked with a thorn in the saphena vein, where it gathers its branches upon the inside of the leg. He was not sensible of receiving the injury at the time ; but, upon returning home, the family observed blood running down his stocking ; and, upon examination, he found the prickle sticking in the vein. He, of course, thought little of it ; but it festered, and looked unkindly for some time. By and by, a little tumor formed upon the part ; and further up the limb, the veins in successive stages became enlarged, with varicose circles of veins insulated apparently at first, and forming distinct tumors in the course of the saphena and its branches. Can there be a doubt, that in this case the varicose enlargement was a consequence of the injury received, any more than that in other instances inflammation and suppuration are the effect of injury ? We are accustomed to find contraction and thickening as the consequences of inflammation : both of these took place here, and are not incompatible with partial dilatations. All varicose enlargements (and I regret never having had an opportunity of dissecting the veins in such a state) are to the feeling irregularly hard. There is a deficiency felt at intervals ; a pitting into which the finger seems to sink, with hard incompressible edges. These indurations are more probably formed by the indurated coats in the abrupt angles of the branches than by concremented blood.

A state of the veins, not it is to be hoped strictly analogous to the last case, but illustrated by it, sometimes takes place without any apparent cause. Tumors will gradually arise from veins, which, upon dissection, are found to contain only a confused mass of coagulated blood and mucus, blending all distinction of bones, membranes, and muscles. Such tumors will sometimes seem to take their origin from the bones, being small, inert, firm tumors, at first ; but, by slow progression, assisted perhaps by the means used to bring them to suppuration, increasing till, upon a rash attempt to extirpate them, it will be found that they are intersected with lamellæ of bone, and that it is absolutely necessary, from the confusion of diseased parts, to finish the operation by the amputation of the limb.

We should perhaps class with these last, such tumors as, appearing at birth hardly raised above the common integuments, gradually dilate as childhood advances, form evidently varicose tumors, having an irregular knobular surface, and increasing in the brightness of their hues, purples and red, bleed in their ad-

vanced stage, and require operation. Such spongy tumors being allowed to increase too much, and take a firm seat upon the bones, will generally, though extirpated, regenerate. In the operation there is much bleeding; the tumor is, when cut into, like a honeycomb; and the arteries, as if emptying into these sacs, send out their blood with great force. I have seen such tumors on the head, under the chin, and on the belly; though they occur, I believe, more commonly on the spine, in the back or neck. The general opinion seems to be, that they arise from injury done to the child in the womb; an opinion having no foundation but in the desire to explain every thing.

But let me not be understood to say, that such a tumor is simply a congeries of varicose veins; for it is evident, that in these cases, as in other more familiar examples, there is a local disease acting upon the neighbouring veins, and drawing them into disease, allied in its nature to proper cancer. Thus we shall find a tumor growing from some fleshy part, hard and knobular, with distorted veins, with a fretting sore upon its most prominent part, and bleeding, sometimes an acknowledged cancer, yet differing in no very definite character from those of which we have been speaking.

DISEASES OF THE LYMPHATICS.—The superficial lymphatics point out to us, in some instances, the nature of disease; for, being extremely susceptible of inflammation, they apprize us of infection, and lead us by a hard inflamed line to the neighbouring glands. This effect of local poison and inflammation on the absorbent vessels has been long observed; being one of the great proofs of the theory of absorption. But more lately, Dr. Ferriar of Manchester, has endeavoured to prove a more general affection of the lymphatics of the leg and thigh in those swellings incident to women after childbirth. In the writings of that gentleman, we have much to admire; but in a mind inquisitive and ingenious, there is a natural bent and facility of generalising facts and observations, perhaps immature or hastily adopted. It will perhaps appear to an unbiassed mind, that the state of the limb in these cases is more of the nature of a critical swelling, than a merely local affection; and that the obstruction and inflammation of the lymphatics of the limb may be more naturally explained, upon the idea that this inflammation is sympathetic, and communicated from the extremities of the lymphatics to their trunks, than that the disease is primarily in the lymphatics, and that their affection is the cause of the swelling of the limb.

Another instance of disease in the lymphatics, has been communicated to me by Dr. Rutherford; a man eminently distinguished for a perfect command of information on all professional subjects, and who joins to this the happiest talent of illustration, which a varied and comprehensive knowledge can supply.—After violent and long continued exercise, where any part of a limb has been exposed to continued friction (as the inside of the leg or thigh after having been long on the saddle), the lymphatics are liable to inflame; when a hard chord may be traced in their course along the limb to the neighbouring glands. This takes place without any lesion of the cuticle or the smallest ulceration; but it seems to be the mere effect of the continued friction of the coats of the vessel which makes them become fretted and inflamed. In a case of a riding groom, which occurred in the Infirmary here, the inflamed lymphatics were so swelled and tender in their course upon the inside of the thigh, and in the glands of the groin, that the man could not move without excruciating pain.

What the appearance of the lymphatics in such great inflammations may be, we can say only from analogy; for they have been little attended to in morbid dissection: but when we consider that their activity must be influenced by a stimulus propagated from their absorbing mouths to the trunks of the system, we have rather to wonder that inflammation and disease should be so seldom excited in them. Accident shews what from theory we are led to conceive, viz. that the fluids in the lymphatics are accelerated by the action of the muscles; for when in wounds a large lymphatic is laid open, and continues to discharge after the surface is healed, we may observe a gush or acceleration of the discharge upon any exertion of the limb. This accident, from the puncturing of a lymphatic, must happen in every the most superficial

incision, but is not generally observed till the sore is healing ; when, from the tumefied extremity of the vessel, the fluid is seen discharging as from the head of a pimple, and so abundantly as quickly to moisten the dressings. Upon the continuance of this discharge, astringents are generally applied ; but they sometimes fail : and many cases in collections shew, that the discharge continues obstinate under these remedies. A case occurring under Dr. Rutherford, of a wound in the fore part of the leg with an adze, was very simply cured by pressure below the wound in the tract of the lymphatic.

OF THE FASCIA.—Every one is aware of the bad consequence of tight bandaging in inflammation ; and that where the parts are swelling under an unelastic bandage, the inflammation is increased, great pain is excited, and the member is very apt to fall into gangrene. Nearly the same consequences, in a lesser degree, are frequently to be looked for from the binding of the fascia in deep seated inflammation. For the muscular parts swelling, as after penetrating wounds, and being confined by the strong embraces of the fascia, especially in the thigh and fore arm, it causes excruciating pain, with contractions of the limb. The elastic feeling which this tension of the parts gives to the touch in the first stage of inflammation, conveys the sensation of matter beneath, which is a frequent mistake. In abscesses, the fascia being of a more inert texture, not so readily partaking of inflammation and suppuration as the subjacent softer parts, confines the matter, and causes it to spread more extensively amongst the loose cellular membrane.

It was long believed, that in punctured wounds the bad symptoms were owing to the extreme sensibility in the tendinous parts when wounded ; but they are now more universally attributed to wounds of the cutaneous nerves ; while another and distinct train of symptoms follow the swelling of the inflamed parts, while strictly embraced by the fascia. The fascia itself, though insensible in its healthy state, and slow to inflame, is yet difficult of resolution when it does inflame, becoming thickened and contracted ; the cure being only to be accomplished by a free incision. It is this which makes the knowledge of the fascia so peculiarly necessary to the surgeon. If he be ignorant of the course and connections of this membrane, he will make many fruitless incisions before he cuts the fascia so effectually as to take off the tension from the limb.

OF THE LIGAMENT OF THE THIGH, AND ITS CONNECTION WITH THE ABDOMINAL RING.

SOME perhaps may censure the frequent recurrence of the same subject ; but if it be remembered, that the method of dissecting, and the views we have of the parts, essentially affect our understanding of them ; and that, to acquire a thorough knowledge of some of the most important points, we shall more readily succeed, by simplifying our pursuits, it will rather appear that to vary thus the object of our dissection, according to the views which our previous enquiries suggest, will, in the end, enable us to form a juster estimate than if our first efforts were bewildered by too great a latitude of enquiry.

It matters not whether the femoral ligament be considered as a distinct ligament, or as the tendon of the external muscle of the belly ; but the latter supposition makes the more simple explanation.

The flat tendon of the external oblique muscle of the abdomen, after a careful dissection, and when viewed from without, is seen (upon its lower part) sending its fibres obliquely downwards to the os pubis ; and when approaching that bone, splitting, in order to give exit to the spermatic chord. The tendinous fibres are seen crossing again, after having formed the ring. It has been conceived, that this decussating of the fibres makes a provision against hernia ; and that the violent actions of the abdominal muscles, which must press upon the viscera, have a tendency at the same time to draw together these decussating fibres, and prevent the inguinal hernia. But, by a stricter attention to the parts, it will appear, that their

construction is such as to preclude the descent of the viscera when there is no preternatural laxity or mal-conformation.

The ligament of the thigh is formed by the tendon of the external oblique muscle of the abdomen taking a firm hold of the spinous process of the os ilium, and stretching over the muscles and arteries of the thigh to the os pubis. On the outer part, as it rises from the os ilium, it is very firmly tied down by its connection with the fascia of the thigh. In its whole length, but chiefly as it approaches the pubes, it is not the rounded tendon which, from viewing it on the outside, we should expect; but it is turned in and inserted into the os pubis with a flat broad horizontal tendon. The consequence of this is, that at the point towards which the viscera must gravitate in the erect posture of the body, it is very strongly secured: and that the effort of the viscera to protrude is not made under the arch or ligament, but above it; since the margin of the tendon spreads thus horizontally to be inserted into the os pubis.

The spermatic chord lies as in a groove formed by the ligament as it approaches the os pubis; and as the extremity of the ligament forms the lower pillar of the ring, an exit is, by a peculiar yielding or twisting of its more outward fibres, allowed for the chord, without diminishing the strength of the femoral ligament, which, by its horizontal sheath stretching backwards, is firmly inserted into the bone. Thus the spermatic chord is not subjected to the compression of the two pillars of the ring; for as the lower pillar of the ring is the extremity of the femoral ligament, as from its connection with the bones it is immovable by the action of the abdominal muscles, and as this lower pillar holds the chord in a kind of flat groove laid horizontally on the os pubis, its outward fibres only yielding to allow the chord to escape, the consequence is, that the upper pillar (which spreads its fibres on the outside of the lower) does not, when made tense by the abdominal muscles, compress the chord against the lower one. On the other hand, the security of the abdominal ring depends upon the obliquity of the passage, and upon the pressure of the viscera not being made in the direction of the chord, but laterally.

DISSECTION OF THE FEMORAL ARTERY IN THE GROIN.

IN proceeding to dissect away from the groin the glands and fat (as seen in Plate XIII.), we shall find a few delicate superficially distributed nerves coming from under the ligament of the thigh. We shall find also, that the cellular membrane which surrounds the great vessels forms a condensed bed, independently of an aponeurosis upon the subjacent muscles. The inner surface of this cellular membrane is strong from the interlacing of fibres. It covers and invests the great artery and vein. The same condensed cellular membrane is continued behind the vein and artery; and by pulling up these vessels, after dissecting it back from before them (as in Plate XIV. fig. 1.), their branches may be seen piercing it like the vessels of the heart going out from the pericardium. All the vessels in the body are more or less supported in this manner by sheaths of cellular membrane; but it is at such places as this in the groin that it becomes a great object in surgical anatomy. In bringing the parts into the state presented in Plate XIV. fig. 1. if the subject be in a favourable condition, very large lymphatic vessels may be observed coursing obliquely over the great artery, and running parallel to its considerable branches.

EXPLANATION OF PLATE XIV. FIG. 1.

- A, PAUPART'S LIGAMENT, formed by the external sheet of tendon of the abdominal muscles.
- B, The CELLULAR SUBSTANCE, filling up the angle in the groin above the iliacus internus, psoas, and pectenalis muscles.
- C, The CONDENSED CELLULAR MEMBRANE, inclosing the femoral artery, dissected back and held out by

a hook. This sheath consists partly of the common adipose membrane, partly of the layers of the great femoral fascia.

D, A solitary LYMPHATIC GLAND left.

E, The OS PUBIS.

F, The SPINE of the OS ILIUM.

G, The SARTORIUS MUSCLE.

H, The GRACILIS MUSCLE.

I, The first head of the TRICEPS muscle, or ADDUCTOR LONGUS.

K, The third head of the TRICEPS, or ADDUCTOR MAGNUS.

ARTERIES AND VEINS.

1. The FEMORAL ARTERY at its most prominent part.

2. The GREAT FEMORAL VEIN, after being joined by the greater saphena vein.

3. The EPIGASTRIC ARTERY, emerging from the cellular membrane, and going up behind the tendon of the abdominal muscles. Betwixt this artery and the point B is the seat of the femoral hernia.

4. A superficial branch of the femoral artery, supplying several of the lymphatic glands, the cellular membrane, and upper part of the sartorius muscle.

5. Another superficial branch, tending more inwardly to the integuments of the private parts, and called PUDENDA EXTERNA. (See next Plate.)

6, 6. The great divisions of the ARTERIA PROFUNDA femoris, seen piercing the involving membrane.

7, 7. Muscular branches, supplying the sartorius.

8. Muscular branches, supplying the triceps.

9. The ANTERIOR CRURAL NERVE. It is seen branching amongst the muscles, and following the arteries in their great divisions.

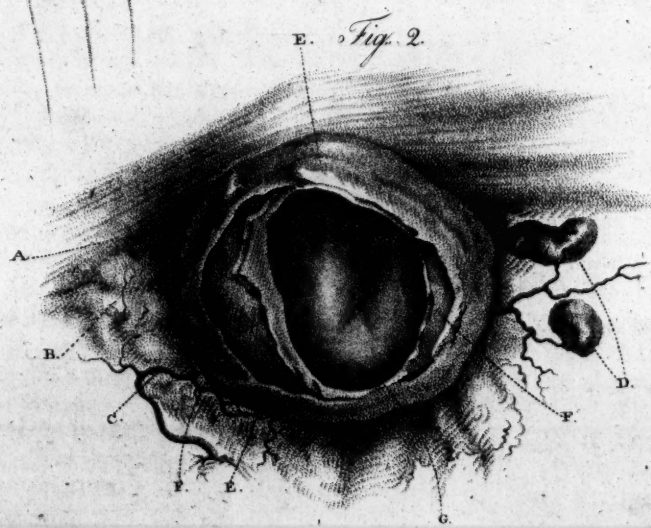
10. Branches of the OBTURATOR NERVE, seen deep amongst the adductor muscles.

OF TUMORS IN THE GROIN.

UNDER this title it is not meant to give such a history of the great varieties of tumors which occur in the groin as properly belongs to books of surgery; but merely to mark their most prominent diagnostic features, as illustrated by a knowledge of the anatomy. These, when the parts are before us, make an impressive and important lesson.

The diseases which may be mistaken and confounded are, femoral or crural hernia with inguinal hernia; bubo with femoral hernia; common scrophulous abscesses of the inguinal glands with the lumbar abscess; and lumbar abscess with disease of the hip-joint.

It is not at every point under the ligament of the thigh that the femoral hernia is found to protrude; but only at that point where the ligament is less firmly tied down, where the cellular membrane is looser, betwixt the femoral artery and vein and os pubis. This, it may be observed, is a small outlet, strictly embraced by the crural vessels and epigastric artery on the outside, and by the firm insertion of the ligament into the os pubis on the other. It is immediately in the bend of the groin, and towards the inside; so that it is very near the seat of the inguinal hernia. And when a femoral hernia in a male is small, and comes down suddenly, and is attended with much inflammation, especially if the patient be corpulent, having much fat upon the pubes, the tumor so spreads upwards, and becomes so tender, that it cannot be freely handled; and it is often a difficult matter to say precisely whether it be a femoral or an inguinal hernia. In all the other instances of disease in this part, and in general in the femoral hernia, the ring and the spermatic chord remain free, so that no room is left for doubt. In the diseases of the



*Drawn by C. Bell & Engr. by J. Stewart.
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spermatic chord, hydrocele of the chord, or varicose enlargement of its veins, the absence of the more urgent symptoms of strangulation undeceives us, though the tumor should resemble hernia. But in the question, Whether it be femoral or inguinal hernia? as the symptoms of strangulation may originate from either, we are left to determine from the local appearance. The difficulty is, however, of no great importance, as our operation has only to be the more cautiously conducted in the first stage.

If a patient with a bubo or GLANDULAR SWELLING, immediately in the seat of hernia, should at the same time be attacked with symptoms resembling those of strangulation, as vomiting or want of passage by stool (a case by no means unlikely), it may become extremely difficult to determine upon the case, notwithstanding the lightness with which it is commonly mentioned. I have not seen a bubo mistaken for a hernia; but what is more extraordinary, I have seen a hernia, and an inguinal hernia too, mistaken for a bubo. The tumor extended down from the ring upon the groin; was small and circumscribed; and so violently inflamed, that it seemed upon the point of suppuration. But the most deceiving circumstance was, that the patient was not reduced; he was strong, and walked stoutly, inasmuch as to make his escape from the surgeons. It was naturally conceived, that if it had been a hernia so far advanced, the patient must have been more reduced, and every symptom of strangulation more urgent. But the man died afterwards, and I saw the dissection.

Herniary tumors are soft and elastic at first, and become firm and more incompressible upon the approach of strangulation. Glandular tumors are in general very hard in their commencement, circumscribed, and moveable; and before they have attained a size which can be mistaken, become softer, more prominent, and discoloured: when matter is formed, it is sufficiently evident. I suspect, that in the case of hernia which I have mentioned above, the inflammation, which occurred so early, had been an erysipelatous affection, occasioned by the attempts to reduce the gut. It appeared dark, and like inflammation verging to suppuration.

The LUMBAR ABSCESS appears in the groin, commonly upon the outside of the femoral artery, under the stronger part of the fascia, and nearer the os ilium. When the tumor forms slowly and regularly, the fascia can be plainly felt; and when it is far advanced, and the fascia gives way, the deficiency is plainly felt with the tense edges of the fascia. The lumbar abscess, however, does not always point thus regularly, but is more extensively diffused in the groin, even surrounding and including the femoral vessels; or it runs so deeply amongst the muscles, that the lancet or trochar cannot reach it with safety. In the dead body, upon laying open the abscess in the thigh, and freeing it of matter, a new discharge is seen to come from within the belly. Upon following this sinus, it is found to run up behind the psoas muscle, upon the vertebrae of the loins, and down the os sacrum; and these bones are generally carious. In some instances the abscess continues its course by the spine and side of the intestinum rectum, and points by the side of the anus. We see sometimes the disease advancing to terrible lengths, yet the patient's life of suffering is prolonged; the spine becomes curved, the belly tense, the whole hip is included in the abscess, the matter having insinuated itself round the fascialis muscle, and down to the head of the thigh bone.

The suppuration of the inguinal glands simply, where there is no communication with the internal parts, may be known by the history of the disease. A scrophulous disease of these glands will commence by thin induration and clustering, and advance slowly to suppuration. In general, though not always, the lumbar abscess will be marked by the greater tension and prominency in the erect posture, in consequence of the gravitation of the matter from the loins.

Collections in the hip-joint may protrude in such a manner upon the groin, as to be mistaken for abscess of the glands, or lumbar abscess. The affections of the joint are so peculiar, however, that they cannot be long misunderstood. Inflammation and disease of the joint is almost of necessity attended with an elongation of the thigh, by the filling up or diminution of the cavity of the acetabulum and elongation of the capsular ligament. In a general affection of the joint from injury, the swelling is very

general, and reaches up within the belly ; it is of a very peculiar firmness, and incompressible nature, like bone or cartilage, about the strong tendons and fascia in the outside of the haunch.

OF THE ANATOMY OF THE FEMORAL HERNIA.

THE frequent occurrence of the femoral hernia must impress us still more forcibly with the importance of this piece of anatomy. Upon recollecting the natural state of the parts, there will be no difficulty in distinguishing their relative situation.

In a recent hernia of the thigh, the tumor is in general small. Very often during the life of the patient it is to be discovered only by the symptoms, not by the swelling in the groin ; and these herniæ are the most dangerous and suddenly fatal.

If the rupture have been suddenly fatal, then proportionally there is less derangement of the natural anatomy ; for it is little altered but by the effect of inflammation. The fascia will be found tense and stretched over the tumor ; the tumor is formed in a bed of inflamed cellular membrane ; and the fibres of the fascia, mingling with the condensed cellular substance, need to be cut through before we arrive at the sac which is formed by the peritoneum. If the thigh have been injected, and the tumor be considerable, we find the external pudic artery *, and inguinal cutaneous branches, ramifying upon the sac, chiefly upon the side next the pubis. The femoral hernia, coming from under Paupart's ligament, does not stretch down upon the thigh, but turns up upon the belly ; so that we may mistake it for the inguinal hernia, and the turning up of the tumor upon the ligament makes it more difficult to enlarge the stricture in the operation.

A celebrated author has said, that the femoral hernia is less apt to be strangulated than the hernia of the ring : but it is evident, that the latter is comparatively less liable to occasional derangement. For not only is the strangulation of the spermatic chord prevented by the mechanism of the parts when in their natural state, but even in hernia (especially where it has continued for some time) the extension of the fibres of the external oblique, round the margin of the ring or neck of the sac, is such, that before the action of the abdominal muscle can pull them, so as to compress the sac, it is held in check by those fibres, which continue in a direct line. Or, in other words, the passage through the tendon of the abdominal muscle is not such as we should conceive from a rupture splitting the parallel fibres, and obtaining a passage liable to compression, by the extension and consequent approximation of those fibres ; but, on the contrary, the fibres are gradually elongated as the rupture protrudes and increases ; thus forming a circular opening, extending outwards and downwards conically, so as not to be liable to compression by the action of the muscles. The parts about the ring, too, it may be observed, are not such as to inflame so readily as those in the arch of the thigh.

Under the ligament of the thigh, there being much vascular cellular membrane and glands, there must be produced great swelling and sudden tension, upon inflammation being communicated to that part ; while the occasional action of the muscles going out from the pelvis, with the tension of the fascia, in the various postures of the body and actions of the limbs, must be a frequent exciting cause, yet I believe the remote cause of the strangulation to be more generally in the state of the bowels.

In operating for the femoral hernia, there are two points of the anatomy of much importance : First, the knowledge of the membranes which invest the tumor, and which must be carefully attended to in the external incision : And, secondly, the danger which attends the second stage of the operation in cutting the ligaments of the thigh, to free the gut from stricture.

* In inguinal hernia, where the tumor frequently acquires a great bulk, the external pudic (a branch from the femoral artery) is greatly enlarged, and extensively distributed over the sac.

EXPLANATION OF PLATE XIV. FIG. 2.

In illustration of the first object, the second figure of the annexed Plate is given, in which there is an external view of the parts after a full dissection.

A, The FEMORAL LIGAMENT, making the stricture upon the protruded parts. The hernia is in the usual place, betwixt the femoral vessels and the insertion of the ligament into the os pubis.

B, CELLULAR MEMBRANE, lying upon the pectenalis muscle. It is evident, even in this view of the parts, how strictly the hernia is embraced by the ligament at A, and the cellular membrane B, upon the one side; and the crural vessels and epigastric artery, and the stronger connections of the ligament with the fascia lata, on the other. Even Pott speaks as if we had all the space betwixt the pubes and spine of the os ilium "to manage the reduction in."

C, TWIGS OF ARTERIES from the femoral artery (probably a branch of the upper external pudic artery), distributed to the sac.

D, INGUINAL GLANDS.

E, A coat of condensed cellular membrane, external to the peritoneal sac. Upon the first view of the tumor, on laying back the integuments, the fascia was continued in fibres from the outside upon this sac of cellular membrane, so as to form a continued sheet, holding the hernia embraced amongst the cellular membrane.

F F, The PERITONEAL SAC, considerably thickened.

G, The INTESTINE, a portion of the ilion. If we were to imitate the colour, it would require a deep purple, with a light tinge of lake over it.

The death of the person from whose body this drawing was taken, was occasioned by the strangulation of the gut. If this had been a male subject, a view from the inside would have been given, shewing the relative situation of the chord, epigastric artery, and mouth of the sac: but the femoral hernia is a rare occurrence in man. The consequence of inflammation, as exemplified in the present case, is the matting together of the cellular membrane. Even the femoral artery, and vein, and glands, were embraced by firm unelastic fat.

In Plate XV. the dangers of the second stage of the operation are pointed out.

FURTHER DISSECTION OF THE ARTERIES AND NERVES OF THE THIGH.

It is needless to make a parade of the importance of this dissection: the next division of our subject, which treats of the ACCIDENTS AND DISEASES, will sufficiently evince it.

As we have now to dissect back the general fascia, and as in separating the muscles we have much of their connections to attend to, it may be well to point out such circumstances as may illustrate the general description of the fascia.

In carrying an incision through the fascia above the tract of the femoral artery, and dissecting back that portion which covers the outside of the thigh, the direction of the fibres on the outer and on the inner surfaces of the fascia will be found very different, shewing the two plates of which it is composed. Upon the outer surface its fibres run in circles round the thigh; upon the inside they run in the length, and are more silvery and closer.

Upon the inside of the thigh, besides the coat of cellular membrane which involves the veins, there is a more appropriated sheath, though by no means like the fascia on the outside of the thigh in strength. Upon dissecting this part of the fascia from the more slender muscles which come down from the os pubis, it will be found to send down interlacing fibres betwixt the muscles, keeping them in some measure distinct from each other. Of this we have an example in the gracilis muscle; for when we slit up and dissect back the fascia which covers it, we still find a condensed membrane separating it from the triceps.

The femoral artery, as it descends from the groin, gets betwixt the tendinous insertion of the triceps and the origin of the vastus internus muscles. Betwixt these two muscles there is such an interlacing of tendinous filaments, that they form the bottom of a deep groove in which the artery runs.

The great accompanying vein keeps on the inside of the artery, and turns more and more under the artery as it descends to pass through the triceps muscle. The vein is very strong in its coats; and perhaps in an operation it might be mistaken for the artery, if the surgeon should be left to judge by the feeling betwixt his fingers, which in many cases is a good criterion.

NOTE OF THE NERVES WHICH ARE TO BE TRACED AMONG THE MUSCLES ON THE FORE PART OF THE THIGH.

OF THE TRUNK OF THE ANTERIOR CRURAL NERVE.—This nerve commences by a twig from the second lumbar nerve. The third is almost entirely expended upon it. It receives likewise a twig from the fourth. The body of the nerve lies betwixt the psoas and iliacus internus muscle. It comes from under the ligament of the thigh, by the outside of the femoral artery, and is in part covered by the vessel. As it lies betwixt the muscles, it splits into numerous branches, which tend downward upon the thigh. It here receives twigs from the lumbar nerves; and it sends delicate branches to the internal iliac muscle, and to the psoas muscle, viz. *recurrentes nervi psoæ*.

OF THE DISTRIBUTION OF THE ANTERIOR CRURAL NERVE.—A very minute knowledge of the muscular branches will add little to our practical knowledge. In dissection, when we find a branch of this nerve going to a muscle, we know its origin and distribution, and consequently its name. Thus, three branches to the sartorius muscle:

Nervus musculi sartorii brevis vel superior,
 ————— medius,
 ————— longus vel inferior.

In the same manner the three nerves of the vastus externus: *Nervi lividi*, or *pectenalis*, going down upon the pectenalis; *nervus musculi cruralis*; *nervus musculi recti*, &c.

OBTURATOR NERVE.—Origin commences with a twig from the second lumbar nerve. As it passes the third lumbar nerve, it is joined by some delicate twigs. It has also additional twigs from the fourth lumbar nerve. It comes out from the pelvis by the thyroid hole, consequently in the middle of the muscular flesh of the thigh, and is chiefly distributed to the adductor muscles. In opposition to the last mentioned nerve, it is sometimes called the posterior crural nerve.

EXPLANATION OF PLATE XV.

A, The tendon of the external oblique muscle of the abdomen, where it forms the *LIGAMENT OF THE THIGH*.*

B, The *SPERMATIC CHORD*. The direction of the chord and of the epigastric artery behind the ligament are marked by dotted lines, shewing the danger in which they stand in the operation for the femoral hernia.

C, The *SARTORIUS MUSCLE* arises from the upper spinous process of the os ilium, and takes a course ob-

* The origin of the epigastric artery from the femoral artery is not so distinctly seen as here represented, unless the ligament be dissected up a little.



C. Bell del.

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liquely down the thigh, and round the inside of the vastus internus muscle. It is here a little turned from its seat, to shew the whole course of the artery, and the muscular twigs which it receives.

D, The RECTUS MUSCLE.

E, The VASTUS INTERNUS MUSCLE.

F, The VASTUS EXTERNUS MUSCLE.

G, The FASCIA LATA, dissected from the great muscles of the thigh, and held back.

H, The PATELLA.

I, The GRACILIS MUSCLE.

K, The SEMI-MEMBRANOSUS MUSCLE.

L, The ILIACUS INTERNUS and PSOAS muscles, sinking down to reach the trochanter minor.

M, The PECTENALIS MUSCLE.

N, TRICEPS MAGNUS.

ARTERIES AND NERVES.

1. The FEMORAL ARTERY, coming from under Paupart's ligament.

2. The EPIGASTRIC ARTERY, turning up behind the tendon of the abdominal muscles. Its course is marked by dotted lines.

3. The CIRCUMFLEX ARTERY OF THE ILIUM. It takes its course upon the spine of the os ilium, and in-oscillates with the lower lumbar artery.

4. A superficial branch; constant in its distribution to the origin of the sartorius muscle, the skin and inguinal glands.

5. The INTERNAL CIRCUMFLEX ARTERY. It is seen to pass down, to go round the head of the thigh bone. It sends branches inwards to the membrane filling up the thyroid hole; sends muscular branches down the top of the thigh upon the back part; and continues its course, gradually diminishing in importance till it reaches the capsular ligament. It supplies the synovial gland in the bottom of the acetabulum. It is generally a branch of the profunda, springing immediately from its root.

6. A branch from the internal circumflex artery, more commonly derived from the main artery (vide Haller's Tab. I. m), which gives off the upper external pudic.

7. The INFERIOR EXTERNAL PUDIC. The pudicæ externæ are irregularly distributed to the external parts of generation, and the integuments upon the inside of the thigh.

8. A cutaneous branch from the femoral artery.

9. The ARTERIA PROFUNDA, the great muscular artery.

10. The EXTERNAL CIRCUMFLEX ARTERY. It runs under the head of the rectus muscle; turns round the great trochanter; and is extensively distributed to the back part of the joint. It sends down extensive muscular branches; and twigs, derived from this branch, emerge from the muscles upon the outside of the thigh, even near the knee.

11. From this great branch of the profunda is sent off the great PERFORATING ARTERIES.

12. The TRUNK of the femoral artery continued, after giving off the profunda. In all this tract, till the artery passes the triceps magnus, it gives only small twigs to the muscles. It lies here betwixt the origin of the vastus internus, and the insertion of the triceps muscles.

13. A cutaneous branch.

14. Branches to the rectus and vastus externus muscles.

15. Branches to the sartorius muscle.

16. The GREAT FEMORAL VEIN. It gets more behind the artery as it descends. They are seen sinking behind the tendinous fibres, sent from the triceps to the vastus internus.

17. The perforating branch of the popliteal artery. Another perforating branch will be seen in the view given of the back of the thigh.

18. This branch perforates the triceps to get into the ham, and runs down (superficially) betwixt the hamstring tendons, in union with the ischiatic nerve.

19. ARTICULAR ARTERIES, branches of the popliteal artery.

20. The ANTERIOR CRURAL NERVE.

21. Branches of this nerve to the sartorius muscle.

N. B. From a branch of the anterior crural nerve, going to the vastus internus, is sent off the *NERVUS SAPHENUS*, or *CUTANEUS LONGUS*. This nerve runs down under the sartorius; is joined by some minute twigs from the deeper muscular branches of the obturator nerve. Continuing its course, it appears as a cutaneous nerve upon the inside of the knee. From this proceeding downwards, it is largely distributed over the tibia; is intricated with the saphena vein; and, finally, ends on the inner ankle and fore part of the foot and toes.

OF THE ACCIDENTS AND DISEASES OF THE ARTERIES IN THE THIGH, AND OF THE POPLITEAL ANEURISM.

THE view of the femoral artery given in Plate XIV. fig. 1. (where it is seen lying imbedded in the groin, and where the relative situation of the most important parts, and the appearance of the cellular membrane, are shewn) points out to the student the necessity of paying attention to these parts in the dissection; for this alone can give him the knowledge which will enable him to recognise the parts when disfigured by disease, or in operations on the living body.

I have had an opportunity of seeing every kind of aneurism; the operation in several cases; but more frequently, and with more improvement, the dissection. In some instances, perhaps, the cases strictly belonged to others. But from such opportunities, I conceive it to be perfectly allowable to draw every possible information; although we surely ought not to think ourselves entitled so pointedly to detail the case as to anticipate the history of it: and above all, no one is in such circumstances entitled to give a critique of an operation, or of the practice of an individual; because things essential to the case, and which may have influenced the practice, may be misunderstood. It is, as far as the opinion of the accuser has any influence, to condemn a man unheard; for accusations will find their way in the world where the vindication shall not reach.

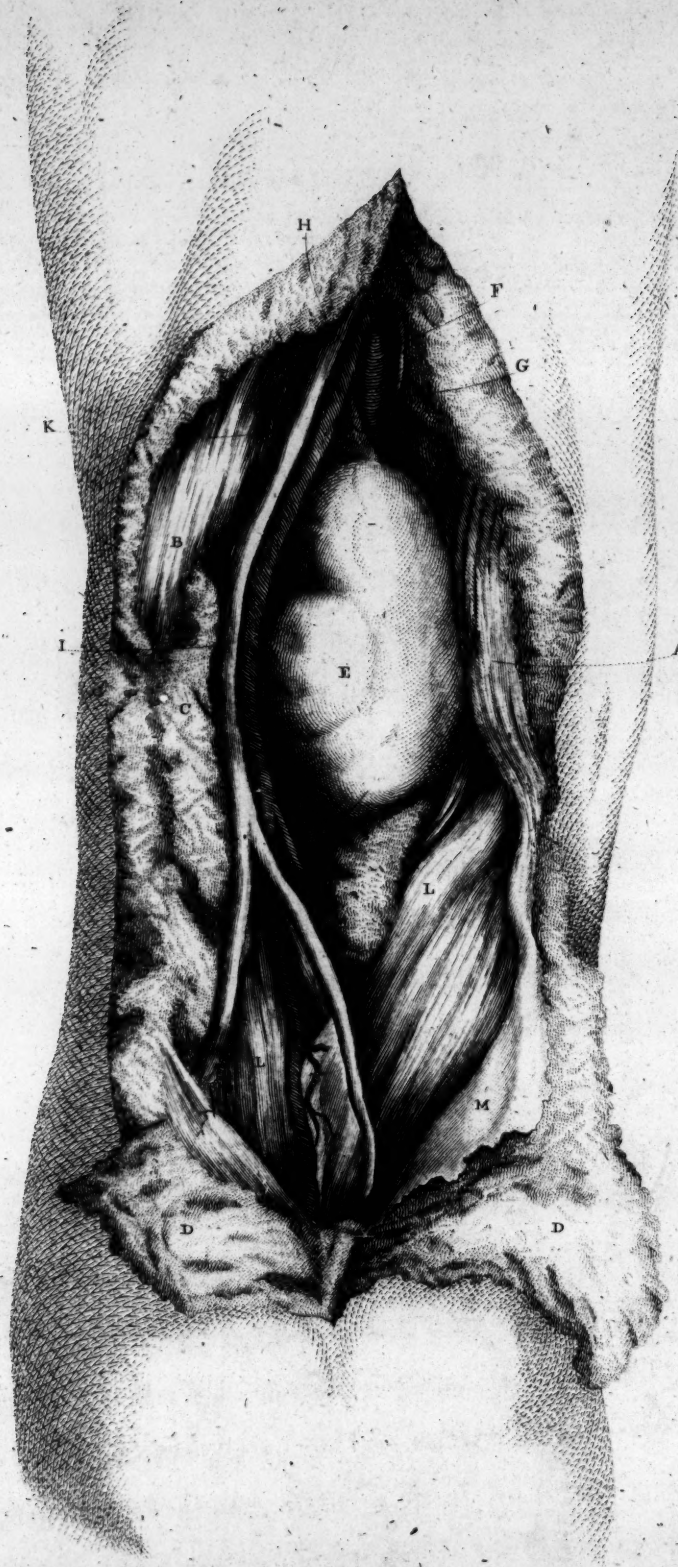
It has been already mentioned, in treating of the diseases of the arteries, how frequent their enlargements are at the flexures of the groin and ham; and the explanation which appeared to be the most natural of this circumstance was there fully detailed (see p. 62.) But it is not merely the structure or situation of those parts which occasion the many diseases of these arteries; they are besides exposed to many accidents.

A wound of the great artery high in the thigh is suddenly fatal. If by a slighter puncture, or the external wound healing quickly in consequence of compression, an aneurismal tumor should be formed, those connections amongst the muscles, which have been carefully pointed out, cannot withstand the continued impulse of the blood; but in a short time the blood driving amongst the muscles, insulates them; and upon operation an extensive irregular cavity is found.

It must be a much more difficult operation to tie a wound of the lesser branches of arteries, than where the trunk is pierced; for if the wound be deep, others are, in searching for the wounded artery, unavoidably cut, and even the great trunk endangered; and on enlarging the wound, there is such confusion of the effused coagulated blood in the interstices of the muscles, that the artery is with difficulty found, and extensive incisions are necessary; which, if not very cautiously made, increase the evil.

In the encysted aneurism the progress of the tumor is slow. In a case of aneurism in the groin, to which





Drawn by Charles Bell.

Engraved by J. Giant.

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I paid particular attention, a small tumor arose immediately below the ligament of the thigh. It remained stationary a long time; but upon some slight exertion it suddenly enlarged, stretching down the thigh. Here its progress seemed again arrested for some time; but it again increased, and showed, by the knobby figure of its surface in its last stage, these three successive changes which it had undergone. The smaller division of the tumor which first arose, gradually lost its pulsation; whilst the beating was very great in the more extensive tumors further removed from the ligament. When the two hands were extended over the tumor (for its size was so great), the beating of the collateral arteries was distinctly felt on each side round the base of the tumor. Though the veins of the thigh were much enlarged (the aneurism compressing them as they go up under Paupart's ligament), the limb was not oedematous, which generally happens in such cases.

The DISSECTION showed exactly what the preceding views of the anatomy would lead us to expect. Upon the most prominent part of the tumor, and where the pulsation had been more distinctly felt, the skin and fascia and sac of the aneurism were blended together. Upon the outside of the thigh, the firm and tendinous aponeurosis tied down the aneurismal sac. The aneurismal sac was distinct, and separated the clots of blood from the surrounding parts; but still it was impossible to distinguish whence it was derived. The external iliac artery was much enlarged and ossified; and along the whole track of the aorta several enlargements and ossifications were found.

We cannot be at a loss to account for the successive stages of the growth of the tumor, nor for the want of pulsation in that first formed. The tumor in the beginning was probably formed by the dilated coats of the artery, and they were sustained by the uniform resistance of the surrounding parts; but upon the failure of some of the connections of the fascia, a sudden dilatation was allowed, and the tumor spread irregularly to the weaker points, and down the thigh, in the direction of the original impulse of the blood. While the dilatation is so small, that the blood keeps moving in it, there is probably no coagulum formed; but when it stretches into distinct sacs, the stream is diverted from the original channel, and the tumor first formed fills with firm coagula, and the pulsation is consequently suppressed*.

When the operation for aneurism is performed in the groin for a case like the present, it cannot succeed; and the practice of the most expert surgeons shows us the confusion which is likely to follow. Upon the first incision for laying bare the sac, so many collateral arteries (which we have noticed to be much enlarged), and the veins, too, which are likewise enlarged in that direction, in consequence of the obstruction and pressure of the tumor, pour out so much blood, that the whole operation is to be done upon parts covered with blood, where the only guide is the feeling†. In regard to the ligature of the great artery, we must be under perpetual alarm; and for the space of two weeks we cannot be assured that the failure of the ligature, or rather the ulceration of the coats of the artery by the ligature, will not be instantly fatal. Or, if the bleeding should for this time be stopped by the surgeon, the repeated failure of ligatures, and the endeavour to follow up the trunk of the artery below the ligament of the thigh, with the deluge of blood, and faint exertions of a patient dying in your hands, make a terrible scene.

In following the crural artery in its important distribution, as exhibited in Plate XV. we see the utility of a thorough knowledge of the anatomy, and of the relation which the sartorius bears to the track of the great artery and branches of the profunda; and we must be aware how very difficult it is, even with this knowledge, to follow in idea the track of weapons, and judge of the importance of the arteries wounded.

* See an interesting paper upon diseased blood-vessels, by Dr. Baillie, in the *Transactions of a Society for the Improvement of Medical and Surgical Knowledge*.

† See an instructive case in "Surgical and Physiological Essays, by Mr. John Abernethy," vol. iii. p. 160.

As the artery descends, it approaches the bone; and especially as it turns round to go into the ham, it lies very near it, which exposes it to be punctured by the spiculæ of the bone in fractures. As the artery here is much more firmly embraced by the muscles than in the upper part of the thigh, there is presented, in such an accident, upon dissection, a very curious appearance; for the large muscles, the vasti, are undermined, and they cover the acquired sac of the aneurism with a layer of fibres, causing it to resemble a strong muscular bag.

OF THE OPERATION ON THE FORE PART OF THE THIGH FOR THE POPLITEAL ANEURISM.

PARTICULAR attention should be paid to the anatomy of the crural artery, as it pierces the triceps muscle; with a view especially to the high operation for the popliteal aneurism. We shall by and by consider the preference which the operation performed at this part holds over the older manner of operating for this kind of aneurism. The anatomy, as pointed out in the explanation of Plate XV. will show us what parts we are to attend to in the operation; but it may be necessary to point out the means of hitting these parts accurately on the living body. We cannot study surgical anatomy by dissection alone; but by a careful examination and comparison with the points of the living body, which are to be our guides. Here, for instance, the course of the sartorius muscle is of infinite importance. It is not easily brought into such action as will show its course on the limb; but if a weight be placed upon the ground, and we attempt to shove it sidewise with the ball of the great toe, it will be brought to swell and show its course. The incision is to be made upon the outer margin of the muscle, beginning a little below the middle of the thigh, and following the curve of the muscle. In pursuing this first incision under the sartorius (its upper surface being kept in adhesion with the integuments), and betwixt the origin of the vastus internus and the insertion of the adductor magnus into the thigh bone, we find the artery covered by irregular fibres of the fascia. There appears to be no foresight nor method of operating which can ensure success in this operation, except by guarding against too large an incision; by the accuracy with which it is made to correspond with the point of the artery to be tied; and by taking care that, in uncovering the artery, the parts are not too much loosened, especially the sartorius muscle; and by cutting the artery betwixt the two ligatures, and allowing it to contract and bury itself amongst the cellular membrane. When the wound is extensive (and it is perhaps impossible to avoid it in a big and fat man), a large suppurating sore is the consequence; and there will be a greater chance of the sinuses forming up along the side of the artery, which sometimes takes place even in the most dexterous operation. The consequence of this state of the artery is, that instead of being supported by the surrounding parts, it lies surrounded with matter; the ligatures, like setons, keep up the discharge; and the vessel ulcerating, the patient dies by the loss of blood, if not by one gush, at least by successive smaller bleedings. Another circumstance with regard to the sartorius muscle is, that when it is left loose in the wound, it swells and fills up the opening, so that the matter is confined.

OF THE ANATOMY OF THE HAM, AND OF THE ANEURISM AT THIS PLACE.

As the anatomy of the ham, and the disease of the artery, have so strict a connection with the subject of which we have now been treating, it will be better to finish the consideration of them here, than to leave it for separate explanation after the dissection of the hip and back part of the thigh.

Upon laying aside the true skin and superficial cellular membrane from the back part of the knee-joint, we have first to observe, as of the utmost importance in the diseases and operations, the strong fascia which covers the muscles and great vessels and nerves. We find a strong layer of fibres coming down obliquely from the outside, derived from the fascia lata of the thigh. From the projecting head of the fibula there runs upwards a layer of silvery fibres crossing the first. From the tendon of the membranous muscle an aponeurosis comes down, which, gaining additional fibres as it descends, forms a very strong sheath, covering all the back part of the leg. In other words, betwixt the two condyles of the thigh bone, and from the head of the fibula and betwixt the ham-string tendons, a strong fascia of interwoven fibres is extended, and this is prolonged down upon the origin of the gastrocnemii muscles and back of the leg.

Upon flitting up and dissecting back the fascia, the great nerve appears. It comes down betwixt the biceps and membranous muscles, on a level with the top of the trochanter. It splits into two great branches: the greater continues its course betwixt the heads of the gastrocnemii muscles; whilst the lesser goes outwardly and obliquely downwards superficially (but under the fascia). Splitting into branches, there goes off from the lesser branch, directly in a middle course betwixt the gastrocnemii muscles and fascia, a small nerve, which is accompanied by a considerable vein. But these will be more minutely detailed in the succeeding part of the work.

Below the nerve, and the superficial vein and long slender artery which accompanies it, there is much cellular membrane and fat. Under this fat, and close to the bone, lie the popliteal artery and vein. They are imbedded in this tissue, and are intimately connected together; the vein more outwardly in its uninjected state clinging round the artery, and the lesser branches of veins striding over it.

If the parts be accurately retained in their natural situation during dissection, it will be seen, that in order to find the easiest access to the artery in operation, our incision should be made rather towards the outer hamstring than immediately in the middle. By this means we keep to the outside of the ischiatic nerve. We shall find the artery lying deep and covered with the vein; and to tie it separately, it must be disentangled from under the vein. But let us consider the state of the parts in disease.

STATE OF THE PARTS IN POPLITEAL ANEURISM.—The limb is generally œdematous; sometimes so much so as to make the pulse at the inner ankle to be felt with difficulty, independently of its faintness from the aneurism. The limb is in general considerably bent. Round the whole knee-joint there is much swelling; so that the tumor in the ham is not very distinct, but has more the feeling of general tension.

Upon laying open the integuments, the tumor comes more distinctly into view, distending the fascia.

With regard to the appearance and situation of the parts, particularly of the nerve, and great vein, and lesser saphena, it must depend upon the direction in which the coats of the artery first give way. If, as in the annexed Plate, the artery shall have given way towards the inside, then the tumor will increase in that direction chiefly; while the artery itself will, in some degree, be pushed in the opposite direction, and the nerve and the vein will be crowded towards the outer hamstrings.

For the same reason, when the tumor, while yet small, has got to the outer side of the vessels, as it enlarges it pushes them towards the inside; or the nerve may even be carried directly forward upon the tumor. The natural anatomy, therefore, can only teach us the appearance of the parts, enabling us quickly to recognize them; but we can never *à priori* know their situation in this disease. In viewing Plate XVI. we should immediately determine, that the tumor could not originate from the coats of the artery, nor be an extension of them, since the tumor is so abrupt and circumscribed, and the artery immediately above partakes so little of the enlargement. It is only by observing the progress of

similar tumors in the breast and belly, that we are convinced of the great dilatation which membranes will allow. They acquire so gradually additional strength and increase of thickness, that unless we were in a manner witness of the gradual change in the nature and properties of the arterial coats, we could not doubt that these tumors were formed by the cellular membrane gradually condensing, in consequence of inflammation and the impulse of the blood.

The popliteal aneurism takes place exactly in that part of the artery which must accommodate itself to the flexure of the joint. It would appear, however, that sometimes it occurs lower, in consequence of some violent action of the heads of the gastrocnemii muscles, or where the arteries of the leg are given off. The ostensible reason for the new method of operating, viz. on the fore part of the thigh, is, that the artery may be supposed to partake more of the disease, in proportion to its proximity to the tumor. But this is putting the merit of the operation upon an insecure footing; for we know that the diseased state of the arterial system is always greater towards the trunks, and that it is gradually encroaching upon the extremities; that the disease is common to all the system, though the peculiar situation of the artery subjects it to additional risks. These may even be increased by the circumstances of a patient's general habits or way of life; but especially this disease is frequent in such as keep the joint habitually bent, but are liable to occasional violent efforts of the limb, and chiefly of the gastrocnemii muscles. It was formerly observed, that horsemen were more especially exposed to it; and that class of men still continue to be the great sufferers by this disease. Whatever may be our reasoning upon this fact (see p. 62.), it is evidently to be attributed to some cause which affects the portion of the artery which is subject to the flexion of the joint only; and if the ligature can be as easily and effectually secured three inches above the joint as upon the fore part of the thigh, it will be as effectually removed from those causes of failure of the artery which are peculiar to the joint, and there will be less chance of the general affection of the trunks having reached so far. The better reasons for preferring the new operation seem to be, the difficulty of operating in the ham; the depth at which the artery lies; and consequently the difficulty of drawing the ligature accurately: and when the operation succeeds, a permanent contraction of the limb is apt to remain, probably arising from the great nerve being so much exposed in the operation, that it must partake of the inflammation, and remain in the midst of the parts condensed and hardened in consequence of it. The power, or expediency rather, which the higher operation gives of tying the artery again and again, following it up the thigh as the ligature successively gives way, is but a forlorn hope. This is not the merit of the operation. It is, that it allows us at once with a small incision to tie the artery; and when firmly secured with ligatures in the extremities of the incision, to cut in the middle portion, which allows the ends to shrink, and bring themselves amongst the cellular membrane, without interfering with the diseased and disordered parts.

EXPLANATION OF PLATE XVI.

In this instance, the operation above the triceps muscle proved unsuccessful; the limb gangrened, from the ligature cutting the vessel, and the attempt to secure it with the tourniquet!!

- A, The INNER HAMSTRING muscles.
- B, The OUTER HAMSTRING muscles.
- C, Fat left undiseased. A mass of fat is seen filling up the space betwixt the origins of the gastrocnemii.
- D, The INTEGUMENTS fallen down over the back of the leg.
- E, The ANEURISMAL TUMOR.
- F, The artery above the tumor, lying deep and near the bone.
- G, A lesser vein, stretching over the artery to accompany some of the articular arteries.

H, The GREAT POPLITEAL VEIN, separated from the artery by the enlargement of the tumor. When this vein is much compressed, the lesser saphena vein is proportionally enlarged.

I, The ISCHIATIC NERVE.

K, A branch of the FEMORAL ARTERY, above the triceps, accompanying the nerve in its course.

L L, The ORIGINS of the gastrocnemii muscles.

M, The FASCIA dissected back.

OF THE CHANGES WHICH TAKE PLACE IN THE CAPACITY AND ACTION OF ARTERIES WHEN TIED, AND THE CIRCUMSTANCES WHICH INFLUENCE THESE CHANGES.

As morbid anatomy, or the changes which disease occasions, and the effect of operations upon the neighbouring parts, deserve so much of our attention ; and as the laws by which the arteries in these cases are influenced, prove so useful and curious an inquiry, and so necessary to be remembered in determining upon every operation, I shall here endeavour to lay before the reader a few of the more important circumstances which influence the arteries.

What I now most anxiously wish to explain is, the connections and sympathies of the trunks of vessels supplying a limb, with the changes in the limb or part of the body which they supply. When part of a limb is amputated, the trunks of the arteries which supplied it rapidly diminish in size, and contract their diameter. If the lower part of a limb mortify, and the disease gradually encroach upon the limb, and spread upwards, the activity of the arteries is found proportionally decreasing, and their diameter shrinking ; inasmuch, that if it be thought fit to amputate the limb above the diseased part, the size of the arteries will be found diminished, and the bleeding consequently less. In these circumstances, the leg has been amputated without the necessity of tying the arteries on the stump * ; and, upon dissection, it is found that the arteries in mortified parts are stopped with coagulated blood.

In contrast with this, we have to contemplate the changes to which the arteries are subject in the natural growth of the body, or when an adventitious tumor grows upon a limb. As a limb enlarges in the course of nature, the arteries supplying it increase in size and strength. No one in these days will say, that this is merely a dilatation of the artery ; on the contrary, it is an increase of size, strength of coats, and energy of action. In the case of an adventitious tumor growing upon a member, we find the arteries of that member gaining strength and increase of capacity, and enlarging their diameter, and becoming more tortuous proportionally as the tumor increases in size. In reasoning upon these facts, Dr. Hunter writes thus * :
 “ Every body must see, that in this case the trunk of the artery would dilate till it became proportionable
 “ in capacity to its branches ; for till then the trunk would be the narrowest part of the canal, the part
 “ where there would be the most resistance ; and therefore the yielding coats of the artery would give way
 “ till the just proportion was established between the trunk and all its branches.” This explanation proceeds upon a false principle ; for although the trunk of the artery may be supposed proportionably narrower than the branches, yet as it is not narrower now than formerly, why should it give more resistance than formerly ? Should not the greater diameter of the extremities rather lead to the inference, that since the resistance to the passing forward of the blood is diminished, the force of the blood laterally upon the trunk of the vessel is likewise diminished ? But this is not the way in which the difficulty is to be solved : It is evident that an increase of blood is sent to the limb ; and the question is, How is this bestowed ? It is observable by every one in any degree conversant with the trifling accidents and local diseases of the

* See Medical Observations, Vol. II.

body, that where there is an injury, an inflammation, a swelling, whether inflammatory or indolent, there is, according to the importance of the tumor, a strict connection and sympathy betwixt the diseased part, and the vessels more or less remote by which it is supplied. Where there is a smart inflammation, there is a very perceptible increase of action quickly ceasing with its cause. Where there is an indolent tumor, there is a more imperceptible, but permanent, change in the size and activity of the vessels. In this view, I hope, it will appear that the explanation, which rests merely upon the distention and dilatation of the arteries by the blood, is but lame and imperfect; and that it will be evident, that in the vessels of a limb, when influenced by a great tumor growing upon it, the same change takes place as under the influence of the natural growth of the limb from childhood.

Let us take the question in another light. Let us trace the observations of Dr. Hunter to the phenomena which gave rise to his most ingenious reflections, viz. the case of varicose aneurism, in the second volume of the Medical Observations.

In that species of aneurism in which a communication betwixt the artery and vein is formed in the bend of the arm, and by which a proportion of the blood which should circulate in the arm is drawn aside from the trunk of the artery into the basilic vein, and finds a less circuitous route back to the heart, it seems invariably to happen that the brachial artery is enlarged from the axilla down the arm to the communication. It becomes larger, and more tortuous, and its pulsation is more distinctly felt. This increase of diameter and strength, Dr. Hunter ascribes to the derivation of blood by the aperture, and reasons upon it in the words already quoted; conceiving this derivation of blood to act in a manner analogous to the adventitious tumor growing upon the limb. Did the motion of the blood in the arteries depend upon the laws of hydraulics simply—this breach in the vessel, this less circuitous route back to the heart, giving an easier circulation than through the extreme vessels, the supply of blood to the fore-arm would be permanently diminished. But the laws of the economy have directly a different tendency: for as the natural growth of a limb has an immediate effect (by what sympathies, or mode of action, we must remain ignorant), in enlarging the parent trunk, soliciting a greater action and supply of blood; and as, after the natural increase of the limb is arrested, a preternatural tumor growing upon the member will still farther increase the agency of the vessels, it is natural to infer, from such strong analogy, that it is the influence of the fore-arm which occasions the increase of strength in the brachial artery; that the breach in the artery has withdrawn a quantity of blood from the arm, which is supplied by a more vigorous action in the trunk of the artery.

OF THE COLLATERAL ARTERIES IN ANEURISM.—But it is only from a more extensive view of the changes which take place in arteries, that we can form a decided opinion respecting the circumstances which affect them. We should naturally conceive, upon a superficial view, that when the trunk of an artery is tied, the collateral arteries enlarge merely as a consequence of the greater impulse of blood into them. But it is evident, that it is not the impinging of the blood upon their coats which distend them; since, when their extremities are tied, as after amputation, they do not dilate: and from an examination of the collateral arteries in aneurism, we see, that there is not a dilatation or extension of the coats merely, but at the same time an increase of strength and thickness of the coats, as in the natural growth of the arteries. We have to show how the arteries become tortuous, also, as they increase in power; and we hope to show, that this tortuous figure of the artery is the great means of the additional exertion.

In Dr. Hunter's remarks upon the case already quoted, there are several instances of the serpentine course which arteries take, as illustrating the increase and convolutions of the artery of the arm in aneurismal varix. This change he supposes to happen, "because the artery is lengthened, and therefore cannot preserve its course;" and that it is lengthened by the distension of the blood. Mr. John Bell, in his

Anatomy of the Heart and Arteries, has objected to the reasoning of Dr. Hunter, but has come nearly to the same conclusion. "It is merely (says he) a consequence of the long continued pressure of the blood: it is this only which can account for the slowly increasing tortuosity in the temples or hands of an old man, or the sudden tortuosity which the newly dilated artery assumes after the operation for aneurism." (P. 291.) When the functions of an artery are considered, this matter will appear in a different light. As the artery possesses a power of accelerating the blood, or of circulating it by an action alternating with the heart, the force exerted by an artery upon the blood must be in proportion to the length of the artery. A portion of an artery, of the length of three inches, will have a greater power of accelerating the blood than one of two inches, though they are equal in diameter; there being in the one a greater latitude of action than in the other. The combination of the muscular reaction of the first artery, exerted to accelerate the blood, will, when compared with that of the other, be as three to two. It follows, therefore, that the increased length of an artery, which has assumed the serpentine zig-zag course which arteries take in the several instances already mentioned, as in the temporal arteries when a great tumor grows upon the head, in the collateral arteries in aneurism, and in the brachial artery in the aneurismal varix, is a means of additional force and power to the circulation. It seems to depend upon the same principle, and to be consonant with the same laws, which influence the increase of the artery in diameter and in muscular strength. That part of the member which remains beyond the ligature of the artery in the operation for aneurism, comes to act upon the collateral branches in a manner strictly analogous to the way in which a great tumor growing upon a limb, or upon the head, acts upon the arteries of the part. The arteries become enlarged and tortuous, with an increase of pulsation and force; or the limb acts upon its collateral arteries as its growth did upon the trunk, there being such an effect mutually existing betwixt the increase of the member in bulk, and the capacity and energy of the arteries which supply it. The serpentine form of the arteries in old age is the natural course of the economy acting in a uniform tenor from childhood. It is a mark of the gradual failure of the activity of the arteries; and at the same time a temporary relief from that failure, and a means of supporting the action of the system.

The increase of the collateral arteries after the operation for aneurism, which from experience we know to be the harbinger of a successful termination, and of the closing of the trunk, is to be accounted for upon the same principle. It shows a degree of youthful pliancy in the branches; it proves that the influence of the limb has succeeded; that the current of blood has changed; and that the trunk of the artery is left dormant to take those changes, which are completely to preclude the flow of blood. (See Part Second, under the title, Of the State of the Vessels in Abscesses.)

The numerous melancholy instances of the death of patients from the operation of aneurism, teach us the importance of attention to the state of the system in determining upon the operation. If the patient be young, and the aneurism have been produced by an accident, as a violent strain and twisting of the knee-joint, the spiculæ of a fractured bone, puncturing of the artery, &c. to tie the artery, even by an operation apparently bold or fool-hardy, will be attended with success; and so all experiments upon animals will be. But we must not be misled to conceive that, without regard to circumstances, an operation, if done after a certain manner, and with such and such stages, shall be universally successful. It is to the state of the patient that we are chiefly to look. A man far advanced in life, with a diseased state of the arteries, will fall a sacrifice, however dexterously the operation may be performed. The collateral arteries will not be in a state to take an increased action, and to enlarge, so as to give a new route to the blood, and make a complete derivation from the trunk, which is tied. But the blood making an effort to keep in the old channel, will retain the artery unsealed by the coagula, which should form in it; and in a few days the ligature cutting its way out by the ulceration of the artery, there will be a profuse bleeding.

It may be useful to observe the consequences of amputation to such a patient, and the changes which we know to take place. After amputation, there is a diminished energy of action in the whole remaining arteries of the limb, and a real permanent contraction of the trunk of the artery and of the smaller branches, the extremities of which were distributed to the amputated parts. When we consider that, in general, in aneurism the arteries are in a diseased state, and that their partial failure is to be taken as a proof of this, is not the diminution of the diameter of the artery, and of the velocity of the blood, the most likely way to secure the remaining part of the artery from the farther effects of disease? Is it not most likely that, by allowing it a more quiet state, this may secure the patient from the formation of successive aneurismal tumors in the arteries connected with that limb? Thus differently do facts prove the case to stand from what a superficial observation would lead us to infer. We should conceive, that the amputation of a limb would endanger the remaining stump by the greater impulse communicated to the obstructed extremities.

In offering these remarks, I mean only to illustrate the laws of the animal economy in these diseases; not to draw unwarily a practical conclusion: for in determining upon the propriety of amputation, there are circumstances to be attended to which do not fall under our consideration; and particular attention must be paid to what has been observed as the consequence of amputation to a system unreduced by previous disease.

DIRECTIONS FOR THE BINDER.

PLATE XIII. to face	-	-	Page 106
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A
S Y S T E M
OF
D I S S E C T I O N S.

P A R T V.

CONTAINING

DISSECTIONS OF THE BACK PART OF THE THIGH, AND OF THE LEG
AND FOOT.

WITH PLATES.

SECOND EDITION.

BY CHARLES BELL, SURGEON.

EDINBURGH:

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1800.



A

S Y S T E M

OF

D I S S E C T I O N S.

DISSECTION

OF THE

ISCHIATIC AND POSTERIOR ILIAC ARTERIES, AND PARTS ABOUT THE HIP-JOINT.

THE glutei muscles are gross and flabby ; and so much cellular substance and fat is entangled with their coarse fibres, that it is difficult to make a neat dissection of them. But this is a very important dissection ; it is much connected with that of the perineum ; and both parts are much exposed in falls, to dangerous bruises ; and to deep wounds, from sitting unwarily down upon sharp points ; fistulous sinuses too, sometimes take their course amongst the cellular membrane, and ligamentous parts here.

When the skin and fat are dissected from the great gluteus muscle, and when this muscle is lifted from its origin, and left hanging by its tendon, a great branch of the gluteal artery is seen to emerge from betwixt the gluteus medius and piriformis muscles ; one division of this artery extends round upon the ilium, and sends twigs backwards upon the sacrum, while another lies betwixt the gluteus maximus, and the gluteus medius.

The third branch of the gluteal artery is to be followed under the gluteus medius. Without raising this muscle, but by undermining it, holding it aside, and exposing the GLUTEUS MINIMUS, we see the whole course of the gluteal artery, and can understand the effect of punctured wounds at this place ; and how the aneurismal blood forces up these muscles from the os ilium, destroys the cellular membrane, and distends the coarse fibres of the muscles into the sac of the aneurism. We understand also, how the puncture of the gluteal artery forms an aneurismal tumor, so large, and so covered with these glutei muscles, that the pulsation is not communicated to it, and the surgeon takes it for a common abscess, and pushes his lancet into it.

The ARTERIA ISCHIADICA comes out from under the piriformis, whilst the gluteal artery appears on its upper edge. The ischiatic artery and the great nerve come out together betwixt the piriformis muscle, and the sacro-ischiatic ligament. This artery lying upon the back part of the hip, is under the gluteus maximus ; it sends its branches round towards the anus, to the perineum, to the upper part of the thigh, and anastomoses with the internal circumflex artery.

For continuing the dissection down the thigh, there is no further knowledge necessary than what may be sufficiently acquired from the plate; unless perhaps a slight note of the cutaneous branches of the ischiatic nerve be required.

CUTANEOUS BRANCHES OF THE ISCHIATIC NERVE, IN THE BACK PART OF THE THIGH AND HAM.

NERVUS CUTANEUS POSTERIOR ET SUPERIOR is the first branch of the great nerve, before it has escaped from the pelvis; having run parallel with the great nerve for some way, it takes an additional flip from it. It divides itself into four branches. The first coming out from under the gluteus muscle, holds its course inwards to the scrotum and inside of the thigh: The second branch having divided, pierces the fascia, and is lost upon the fascia and skin: The third branch follows nearly the same track, but extends further down the outside of the thigh: And the fourth runs down the middle and back part of the thigh reaching to the ham; it appears first by the inside of the great head of the biceps muscle.

NERVUS CUTANEUS INTERNUS SUPERIOR.—This nerve rises in common with a branch going to the long head of the biceps muscle; after which it proceeds superficially down the inside of the thigh.

NERVUS CUTANEUS INTERNUS INFERIOR is distributed to the inside of the thigh and knee. This branch comes off from the ischiatic nerve, after it has passed the QUADRATUS FEMORIS muscle; and, nearly in the same place, is given off a MUSCULAR BRANCH TO THE QUADRATUS FEMORIS.

Nearly about the middle of the thigh bone, there goes off outwardly a very considerable branch, which is distributed entirely to the muscles, to the adductor magnus, semi-membranosus, semi-tendinosus, and biceps.

NERVUS CUTANEUS EXTERNUS.—This branch appears superficially above the fascia, on the outside of the knee, and takes its course upon the outside of the leg. Higher upon the outside of the thigh, the cutaneous nerves are derived from those coming out upon the groin.

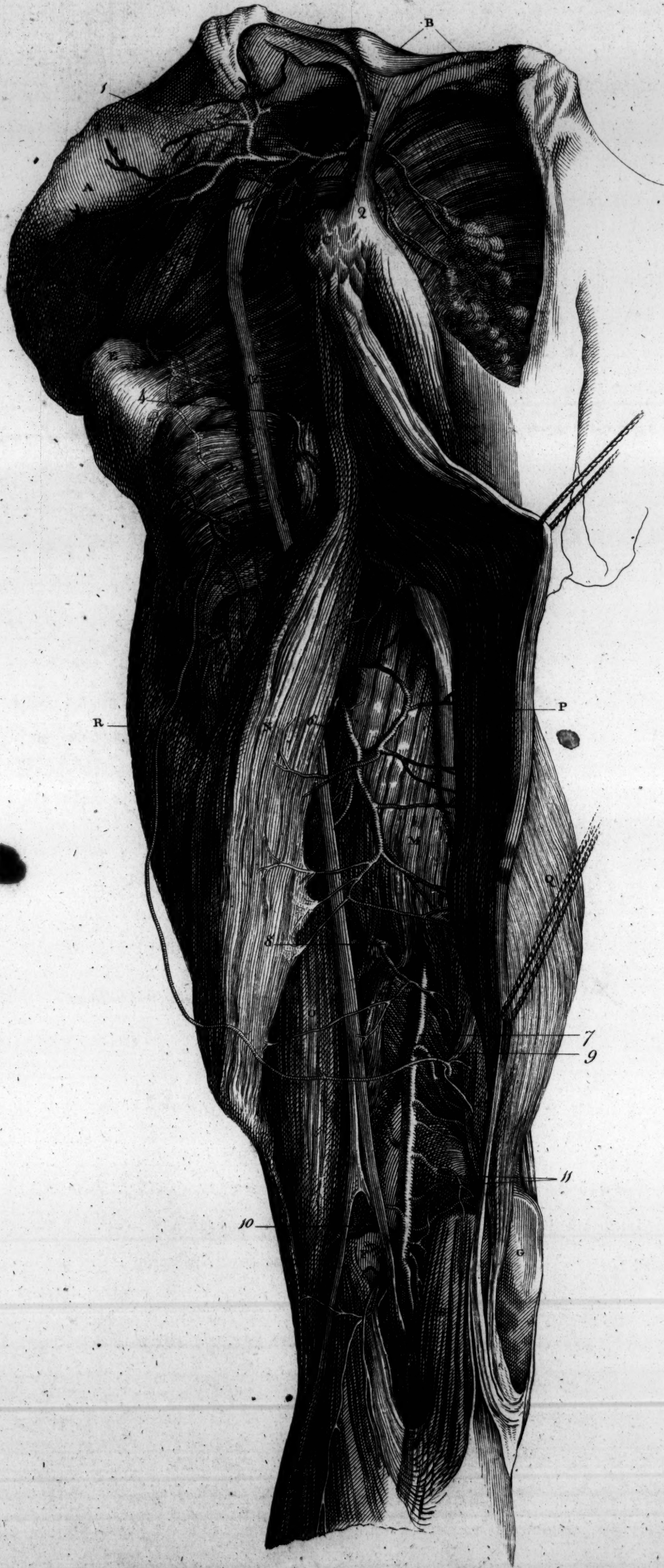
EXPLANATION OF PLATE XVII.

This plate is taken from Haller; because, after a good injection and careful dissection, the parts will come very much into this form—I disregard the letter-press of Haller; but mark, as I have hitherto done, the leading points in the anatomy and manner of dissecting.

PROMINENT POINTS OF BONE AND MUSCLES.

- A, The dorsum of the ilium.
- B, The os sacrum.
- C, The tuberosity of the ischium.
- D, The sacro-ischiatic ligament.
- E, Trochanter major.
- F, The internal condyle of the thigh bone; G, the external condyle.







H, The PYRIFORMIS muscle; which, arising from the hollow of the os sacrum within the pelvis, is inserted into the root of the trochanter major.

I, The GEMINI and OBTURATOR INTERNUS. These muscles are very poorly expressed here: But in the dissection, the strong and well formed tendon of the obturator will be observed coming out betwixt the ligaments, from its extensive origin from the membranes of the thyroid hole; and on each side of this, the gemini, viz. two fleshy slips, arising from the os ischii, and inserted into the trochanter major.

K, QUADRATUS FEMORIS; a flat, square muscle, passing from the ischium to the root of the trochanter.

L, TRICEPS BREVIS crossing the middle of the thigh, from the ramus of the os pubis to the trochanter and linea aspera.

M, The TRICEPS MAGNUS; through which the artery is seen to pass.

N, The long head of the BICEPS FLEXOR coming from the ischium.

O, The short head of the BICEPS rising from the thigh bone:—the tendon of this muscle is the outer hamstring.

P, The SEMI-TENDINOSUS—it is inserted into the head of the fibula; is seen rising from the tuberosity of the ischium;—it adheres for some way to the biceps, but parting with it, leaves the back of the knee-joint unprotected;—it is inserted into the head of the tibia.

Q, The SEMI-MEMBRANOSUS having nearly the same origin and insertion with the last muscle, these two form properly the inner hamstring tendons.

R, The VASTUS EXTERNUS MUSCLE.

S, S, The heads of the GASTROCNEMIUS MUSCLE.

ARTERIES AND NERVES.

1, The GLUTEAL OR POSTERIOR ILIAC ARTERY.

2, The PUDIC ARTERY, which seems to have been here in common with the ischiadic.

3, The artery to the penis; which is seen to give arteries to the levator ani, and perineum.

4, The extreme muscular branches of the internal circumflex artery, (5, Plate XV). It anastomoses with the ischiatica.

PERFORATING ARTERIES OF THE PROFUNDA FEMORIS.—These are such branches of the profunda as perforate the triceps muscle (which, in some measure, forms a plane of division betwixt the fore and back parts of the thigh), and are distributed amongst the flexor muscles.

4, The extreme branches of the INTERNAL CIRCUMFLEX ARTERY, Plate XV. 5.—which being frequently a branch of the profunda, is the FIRST PERFORATING ARTERY.

5, The FIRST PERFORATING branch of the profunda, sent chiefly to the triceps brevis.

6, The SECOND PERFORATING ARTERY, ramifying to the biceps, semi-membranosus, and semi-tendinosus muscles. These muscular arteries, the extreme branches of the internal articular arteries, the first and second perforating arteries, form a train of anastomoses, reaching from the ischiatic artery to the popliteal artery.

7, The TRUNK OF THE POPLITEAL ARTERY, where it has perforated the triceps muscle, and lies close upon the bone.

8, A considerable muscular branch, sent off as the artery is passing the triceps muscle, and which is chiefly distributed to the biceps.

If, as in all probability, there was in this subject a great muscular branch coming off opposite to this one, and which in many subjects is distributed to the inner hamstring muscles and vastus internus, it would be the FIRST PERFORATING ARTERY of the popliteal artery; while this (8) is the SECOND PERFORATING ARTERY. THE PERFORATING ARTERIES of the popliteal artery, are those branches which escape from the hollow betwixt the hamstring tendons, and pass through the flexor muscles.

9, A muscular branch to the semi-membranosus muscle, which sends a long reflected branch, inosculating with the perforating arteries of the profunda, upon the great fascia of the thigh.

The ARTICULAR ARTERIES, which are branches of the popliteal artery above the condyles, are in systematic arrangement three in number, but they are very irregular. That branch however marked (10), the lower and external articular artery going over the outer condyle, is very constant; while for the internal articular artery, as it has occurred here, there is more frequently substituted lesser branches.

11, THE AZYGOS ARTERY OF THE JOINT, which takes a middle course betwixt the condyles, is frequently a branch of the outer articular artery.

12, The great ischiatic nerve seen through its whole course.

DISSECTION OF THE BACK PART OF THE LEG.

In page 121, when treating of the popliteal aneurism, a slight description of the fascia which stretches across the hamstring tendons, and of the situation of the great vessels and nerves, was given. To pursue the dissection of the popliteal vessels and nerves, the fascia upon the belly of the gastrocnemius muscle is to be slit up. We find there the lesser saphena vein coming up from the outside of the foot, its trunk lies under the fascia, and shines through it while yet entire; it joins the popliteal vein betwixt the hamstring tendons, about two inches above the condyles; in its course it forms several remarkable inosculation with the saphena major, and is accompanied by two superficial branches from the peroneal and fibial nerves. We find also that the great saphena vein upon the inside, is accompanied with a small nerve, the INFERIOR INTERNAL CUTANEOUS NERVE; which arises from the sciatic nerve soon after it has come out from the pelvis, and which emerges only at the insertion of the sartorius muscle.

Having dissected the parts in the back of the knee joint, and the gastrocnemius muscle, particular attention should be paid to the aponeurotic expansion, investing the flexor muscles, and posterior tibial artery and nerve; for betwixt the strong tendon of the gastrocnemius and the edge of the tibia, the strong cross fibres of a fascia are extended; and even this being slit up, a tough cellular membrane intervenes, betwixt the flexor muscles and the artery and nerve; and these muscles are further enclosed in a peculiar aponeurotic membrane.

These things are remarked, as in themselves important, and to be noticed in the dissection not explained in the Plate.

EXPLANATION OF PLATE XVIII.

FIG. 1.—MUSCLES.

A, The inner hamstring tendons, formed by the semi-membranosus and semi-tendinosus muscles.

B, The outer hamstring, or tendon of the biceps cruris.

C C, The origins of the GASTROCNEMIUS MUSCLE, from the two condyles of the thigh bone. The belly of the muscle D D, is scarcely more than indicated by an outline.

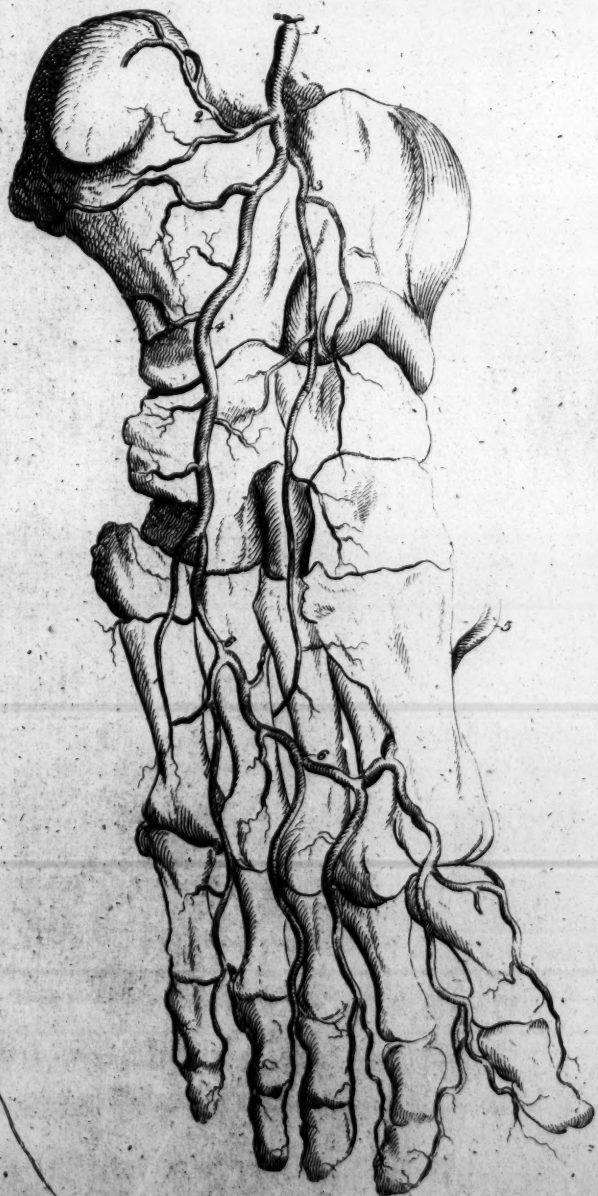
E, The belly of the SOLEUS MUSCLE, appearing from under the gastrocnemius; this muscle arises by two heads from the upper part of the tibia and fibula—it forms a broad flat muscle, of which the margin only is seen here—its fibres concentrating to a middle tendinous line F, coalesce with the tendo-achillis F; which is thus common to both these muscles.



Fig. I.



Fig. II.





G, The **PLANTARIS MUSCLE**, which rising from the external condyle of the thigh bone, lies under the gastrocnemius muscle—it has a small fleshy belly of about three inches, and terminates in the delicate tendon H, which lies betwixt the inner head of the gastrocnemius and soleus, as the oblique direction of the muscle indicates—its tendon adheres to, and is implanted alongst with the tendo-achillis.

I, The tendon of the **TIBIALIS POSTICUS**, passing in its sheath under the inner ancle. This muscle rises from the back part of the tibia and fibula, and interosseous ligament, while its head stretches through betwixt the bones, and takes its origin from the tibia before—its tendon spreads widely over the tarsal and metatarsal bones in the sole of the foot.

K, The **FLEXOR LONGUS DIGITORUM**.—It arises from the back part of the tibia. The fibres converging from the outer and inner sharp edges of the bone, enclose the tibialis posticus, which lies close upon the bone—inferred into the last bone of the four lesser toes.

L, The **FLEXOR LONGUS POLICIS PEDIS**.—It rises from the back part of the fibula, a little below its head, and continues its origin almost to its lower extremity—passing under an annular ligament, it is inferred into the last joint of the great toe.

ARTERIES AND NERVES IN THE BACK OF THE KNEE-JOINT.

1, The **POPLITEAL ARTERY**, where it lies deep betwixt the hamstring tendons.

2, The **UPPER AND OUTER ARTICULAR ARTERY**.—It is seen again in Plate XX. Fig. 3.—It passes here under the tendon of the **BICEPS CRURIS**.

3, The **UPPER AND INTERNAL ARTICULAR ARTERY** passing through the tendon of the triceps, and piercing the lower margin of the vastus internus; it is distributed upon the inside of the knee joint, and inosculates with the lower articular artery of the same side, a branch also of the popliteal artery; but which takes a course more obliquely downwards, and under the internal condyle*.

4, 5, These twigs from the popliteal artery run down superficially upon the heads of the gastrocnemius muscle; they send down long twigs in company with the lesser saphena vein and superficial nerves; and more considerable branches to the origin of the soleus muscle. But there is a more slender twig of artery (5, 5), accompanying the peroneal and cutaneous nerves, prolonged from the popliteal artery, high in the ham.

6, The lower and internal articular artery.

The popliteal artery, and these articular arteries lie deep and near the bone. The ischiatic nerve, and the branches it sends off, are more superficial.

7, The ischiatic nerve—yet here, though in close contact, the tibial and peroneal nerves have already split.

8, The tibial nerve—where it is sinking under the gastrocnemius and soleus, to appear again in company with the posterior tibial artery.

9, The peroneal nerve, which passing over the fibula, sinks amongst the muscles on the outer and fore part of the leg—it is seen splitting into a superficial and a deep seated nerve.

10, A branch from the peroneal nerve, from which the posterior and inferior cutaneous nerve (11) is finally derived, and likewise that twig called *communicans peronei*, which joining with (12) the *ramus communicans tibiei* is finally distributed on the outside of the foot and toes. (Plate XX. 9.)

13, The **VENA SAPHENA MAJOR**—a little drawn from its seat, by the pulling of the integuments.

14, The **POSTERIOR TIBIAL ARTERY** lying parallel with the flexor communis, and with the accompanying

* The external and inferior articular artery; making in all the four articular branches of the popliteal artery—is less constant or important. The recurrent branch of the anterior tibial artery sometimes taking its place.

nerve. These branches which are seen going off, are nameless muscular twigs to the soleus, flexor communis digitorum, and flexor pollicis.

15, The TIBIAL NERVE.

16, A muscular branch from the fibular artery. These parts do not lie thus exposed, but are covered with aponeurotic membranes, as mentioned in the introductory remarks to this dissection.

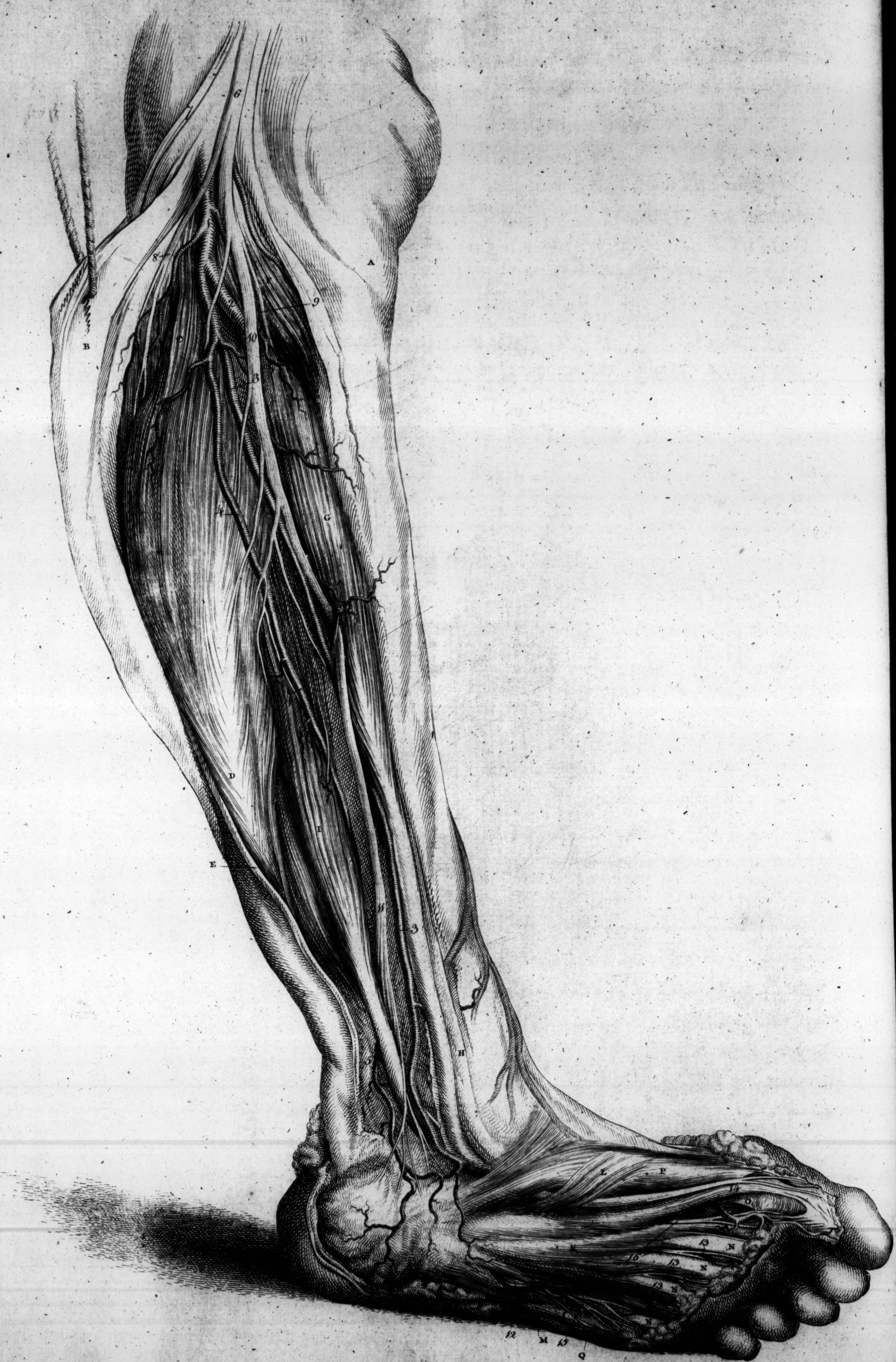
FIG. 2.—This faint sketch of the bones and arteries of the foot is given to illustrate the general course of the posterior tibial artery; and to account for those branches which are only partially seen in the next dissection.

When the posterior tibial artery (1) has got into the hollow of the inner ankle, close by the heel-bone, it sends out two branches; one goes up upon the ankle-joint, and the other (2) ramifies over the heel-bone, and anastomoses with the fibular artery. Proceeding onwards in the groove of the os calcis, it sends off a very principal branch, viz. the INTERNAL PLANTAR ARTERY (3)—which continues a more superficial branch above the tendons, while the main artery, the EXTERNAL PLANTAR ARTERY (4) takes a course more circuitous, deeper under the muscles, but more towards the outer side of the foot.

5, The anterior tibial artery.

6, 6, The plantar arch lying upon the metatarsal bones, and formed by the great anastomosis of the external plantar artery (4), and the anterior tibial artery (5). From this arch are sent off the arteries to the toes, viz. the perforating arteries, which, going deep betwixt the bones, anastomose with the interosseous arteries of the fore part of the foot.





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Drawn by Charles Bell

Engraved by J. Smith

FURTHER DISSECTION OF THE BACK PART OF THE LEG AND OF THE FOOT.

To proceed with the dissection of the muscles, nerves, and blood-vessels of the calf of the leg, the heads of the gastrocnemius muscle are to be lifted from their origin, and the muscle allowed to hang by the soleus; we then see the plantaris through its whole length, lying betwixt the fleshy bellies of these muscles. By separating the soleus muscle from the back of the tibia, and folding the side of it over towards the outside of the leg, we have the view of the parts given in Plate XIX. The smaller flexor muscles are laid open—the branches of the ischiatic nerve and posterior tibial nerve are seen through all its extent, and all the important branches of the popliteal artery. We find the posterior tibial artery and the fibular artery running parallel to each other, high in the leg; the fibular artery is rather the more superficial; but as they proceed downwards, the fibular artery sinks behind the flexor of the great toe, and gets deep betwixt the bones. The anterior tibial artery, the first of these three great divisions of the popliteal artery, is seen going through betwixt the heads of the bones, to gain the fore part of the leg. (See Plate XX. Fig. 1). It is scarcely possible to give a description of the deep seated veins accompanying these arteries; for, after a successful injection of them, they are so numerous, as to choke and hide the arteries from the view. For as there are two *VENÆ COMITES* to each artery; as the tibial and peroneal arteries lie so little removed from each other, and as the veins form frequent communications, the arteries are involved in an irregular mesh of veins.

EXPLANATION OF PLATE XIX

PARTS DISSECTED IN THE LEG.

- A, The head of the tibia.
- B, The GASTROCNEMIUS MUSCLE in outline.
- C, The head of the SOLEUS MUSCLE raised from its origin from the tibia.
- D, Marks where the tendon of the soleus coalesces with the tendon of the gastrocnemius muscle, to form together the tendo-achillis.
- E, The small tendon of the PLANTARIS, which lies betwixt the two muscles.
- F, The MUSCULUS POPLITEUS, which arises from the external condyle of the os femoris, passes fleshy over the joint, adheres to the capsule, and is inserted into the internal edge of the tibia.
- G, The FLEXOR COMMUNIS DIGITORUM.
- H, The tendon of TIBIALIS POSTICUS.
- I, The FLEXOR POLICIS PEDIS LONGUS.
- K, The PERONEUS BREVIS seen retired.

ARTERIES AND NERVES ON THE LEG.

- 1, The POPLITEAL ARTERY, before dividing into the three arteries of the leg. It is here that by the violent action of the muscles, it is sometimes lacerated, or so injured, as to produce an aneurism, destroying the bones and joint.
- 2, The ANTERIOR TIBIAL ARTERY, where it is about to pass through betwixt the tibia and fibula.
- 3, The POSTERIOR TIBIAL ARTERY, where it lies betwixt the belly of the soleus and the long flexor muscles of the toes; and has its name from its situation in opposition to the anterior tibial artery.

4, 4, The PERONEAL ARTERY.—This artery is sometimes a branch of the anterior tibial artery—taking a direction parallel with the fibula, and upon the inside of that bone, it supplies the peroneal muscles and flexor of the great toe—it sends out so many muscular arteries, (some of which inosculate again with the trunk), that it is much diminished before it gains the lower head of the bone. Where the peroneal artery is hid under the flexor tendons, and where it lies betwixt the lower heads of the tibia and fibula, it splits, and sends a branch betwixt the bones, to be distributed upon the outer angle, which therefore is called the external peroneal artery.

5, The INTERNAL, OR POSTERIOR PERONEAL ARTERY.—This is properly the termination of the peroneal artery—it is seen forming a remarkable inosculature with the posterior tibial artery; while its branches are chiefly sent upon the inside of the heel-bone, and above the plantar expansion, upon the outside of the foot, and inosculating with the outer plantar artery (6).

6, The ISCHIATIC, OR POPLITEAL NERVE.

7, The PERONEAL NERVE going over the head of the fibula.

8, MUSCULAR NERVE to the gastrocnemius muscle.

9, A branch perforating the interosseous ligament.

10, The TIBIAL NERVE, where it passes through the head of the soleus, and betwixt that muscle and the flexor digitorum—it is held aside by a pin, so that the muscular branches which it gives to the soleus and long flexor muscles, may be seen stretching over the posterior tibial artery.

11, Here the TIBIAL NERVE is about to pass under the annular ligament, and to divide into the internal and external plantar nerves.

PARTS SEEN ON THE SOLE OF THE FOOT.

A tough granulated fat is betwixt the hard skin of the sole of the foot, and the plantar aponeurosis, which adheres strongly to the aponeurosis, and is with difficulty dissected from it. The plantar aponeurosis passes from the heel to the root of the toes, covering all those parts which fill up the arch of the bones; it therefore gives elasticity to the foot, binds down, strengthens, and gives origin to the lesser muscles—in wounds and bruises it retains the blood or matter, and binds the inflammation and swelling, so as to occasion excruciating pain, and cause the destruction of the internal parts.

K, The middle portion of PLANTAR APONEUROSIS, under which are contained the tendons of the long flexor muscles, and the flexor brevis digitorum.

L, The internal lateral portion of the plantar aponeurosis, which invests the short muscles of the great toe; a strong fasciculus of fibres is seen connecting this with the middle portion.

M, The external lateral portion of the aponeurosis. Fibres are sent down forming partitions, or clasping the muscles and tendons of the foot.

N N N, The TENDONS OF THE FLEXOR COMMUNIS—the aponeurotic expansion splitting to give them passage.

O, The tendon of the flexor of the great toe.

P, ABDUCTOR of the great toe.

Q, ABDUCTOR of the little toe.

12, The EXTERNAL PLANTAR ARTERY making a curve, and appearing more superficially here, before it turns in to form the great arches from which the arteries of the toes are sent off.

13, 13, 13, The ARTERIES OF THE LESSER TOES from the plantar arch.

14, The ARTERY OF THE GREAT TOE proceeding from the anterior tibial artery, where it is about to form the great inosculature with the arch, or termination of the posterior tibial artery.

15, The EXTERNAL PLANTAR NERVE accompanying the artery.

16, The distribution of the internal plantar nerve to the toes, appearing from betwixt the tendons, and splitting upon the arteries.

DISSECTIONS OF THE FORE PART OF THE LEG AND FOOT.

ON laying open the integuments on the fore part of the thigh, we have to take notice again of an important fascia. The fascia is continued down the leg from the hamstring tendons—it takes a firm hold of every accessible point of bone; the head and ridge of the tibia, the fibula, and the whole capsule of the knee, is covered and strengthened by the fascia—below, upon the ankle, it is gathered into stronger fasciculi, which encircle the tendons confining them, and forming the annular ligament.

The saphena vein upon the inside of the tibia accompanied by the internal cutaneous nerve, should not be overlooked. Upon the outside of the leg, about its middle part, and before the fibula, is seen a great branch of the peroneal nerve coming out through the fascia; and a little further down another branch; both spreading extensively over the fore part of the foot.

To proceed with the dissection, and bring the parts to correspond with Plate XX. we dissect off the fascia from the extensor muscles, separating it from its strong connection with the tibia, and folding it back over till we find it taking a firm hold on the fibula. We find, as it is dissected up from the tibialis anticus, extensor pollicis, extensor digitorum, communis and peroneus longus, that the surface of these muscles are ragged, where they took their origin from the fascia.

Upon the fore part of the foot, in like manner, an expansion is stretched over the muscles and tendons, above which run the cutaneous veins and nerves.

EXPLANATION OF PLATE XX.

FIG. 1.—A, The patella—B, Ligament of the patella, connecting it with the head of the tibia.
C, The ridge of the tibia.
D, Head of the fibula—E, Lower end of the fibula, forming the guard of the joint in this direction.
F, The fascia cut up from the tibia, dissected off the extensor muscles, and held back—its firm origin from the head of the fibula is seen, and the manner in which it forms the ligament of the ankle G, by taking a firm hold of the extremities of the bones, and by being strengthened with additional fasciculi of fibres.

MUSCLES.

H, The tibialis anticus muscle taking its origin from the tibia, and from the tendinous partitions. Its tendon is seen in a distinct sheath of the annular ligament—it turns obliquely over the foot, and is inserted into the os cuneiforme internum.

I, The EXTENSOR POLICIS.—It arises from the fibula, passes under the ligament, and over the first joint of the great toe, to be inserted into the second.

K, The EXTENSOR LONGUS DIGITORUM ^{pedis} BREVIS.—It arises from the head of the tibia, from the fascia and tendinous partitions betwixt the bones and edge of the fibula. Its fibres are seen to split as they pass under the ligament, and are sent to the four lesser toes, accompanied by the tendons of the extensor digitorum brevis.

L, The PERONEUS LONGUS arising from the head and ridge of the fibula, and from the upper part of the tibia. Its tendon passes behind the outer ankle. It is inserted into the metatarsal bone of the great toe and os cuneiforme magnum.

The *PERONEUS BREVIS* lies under the last muscle. It arises from the ridge of the fibula and interosseous ligament, and its tendon passes in the same sheath with the peroneus longus. Its tendon *M* runs on the outer edge of the foot, and is inserted into the metatarsal bone of the little toe.

N, N, Mark the fasciculi of the *EXTENSOR DIGITORUM BREVIS*. It rises from the heel-bone and annular ligament—its small tendons run so obliquely inwards, as to cross those of the long extensor passing between them. That tendon which is seen going to the great toe is implanted into the first bone. The other tendons which go to the three next toes are prolonged along the side of the toes, the great tendon gliding between them.

ARTERIES AND NERVES.

1, The most important part of the demonstration is the track of the *ANTERIOR TIBIAL ARTERY* (1), and its accompanying nerve. The manner in which the *ANTERIOR TIBIAL ARTERY* passes between the heads of the tibia and fibula is seen in the last plate. It appears here (1), lying deep between the *tibialis anticus* and *extensor communis digitorum* muscles. It is here guarded by the projecting ridge of the tibia, and covered by the belly of the *tibialis anticus* muscle. It gives off alternately to each side muscular branches; as it descends, it becomes more superficial, and is much exposed in workmen to be wounded with the adze, and in the upper part, it lies close upon the interosseous membrane; but as it descends, it turns round, and lies before the head of the tibia, and passes through the annular ligament under the tendon of the extensor of the great toe.

2, 2, A very remarkable recurrent branch sent off from the anterior tibial artery, immediately after it has perforated the interosseous membrane; from the root of this twig, there is sent down under the fleshy head of the *extensor digitorum communis*, a slender muscular branch. The twig which is seen here, perforates the head of the *tibialis anticus* muscle, runs upon the head of the tibia, gets under the ligament of the patella, while its extreme twigs are extended over the ligament of the knee, and anastomose with the *ARTERIA ARTICULARIS SUPERIOR EXTERNA* (1) appearing here from under the tendon of the biceps muscle, and derived from the popliteal artery.

4, The peroneal nerve which we saw in the last plate, derived from the great ischiatic nerve in the ham.

5, Its deep seated branch which appears again in company with the artery, and separated from it by a pin (7).

6, The superficial branch which is distributed to the peroneal muscles, and superficially upon the fore part of the foot, coming out from beneath the fascia at (8), and turned aside by the raising of the fascia.

9, A nerve likewise distributed upon the fore part and side of the foot, and derived from the cutaneous nerve, which in the last plate is seen running down superficially upon the tendon of the *gastrocnemius* muscle, properly the *nervus communicans tibiei*, which is observed to join with the *NERVUS COMMUNICANS PERONEI* on the back of the leg.

10, The commencement of the *vena saphena*; here we fix our tubes to inject the whole system of the veins of the leg.

FIG. 2.—This sketch of the foot from Haller is added chiefly to show the further distribution of the anterior tibial artery.

A, The tendon of the *tibialis anticus* muscle.

B, The tendon of the *extensor pollicis*.

C, The tendons of the *extensor communis digitorum*.

D, The tendon of the *peroneus brevis*.

E, The *extensor brevis digitorum pedis*.

Plate XX.

Fig I

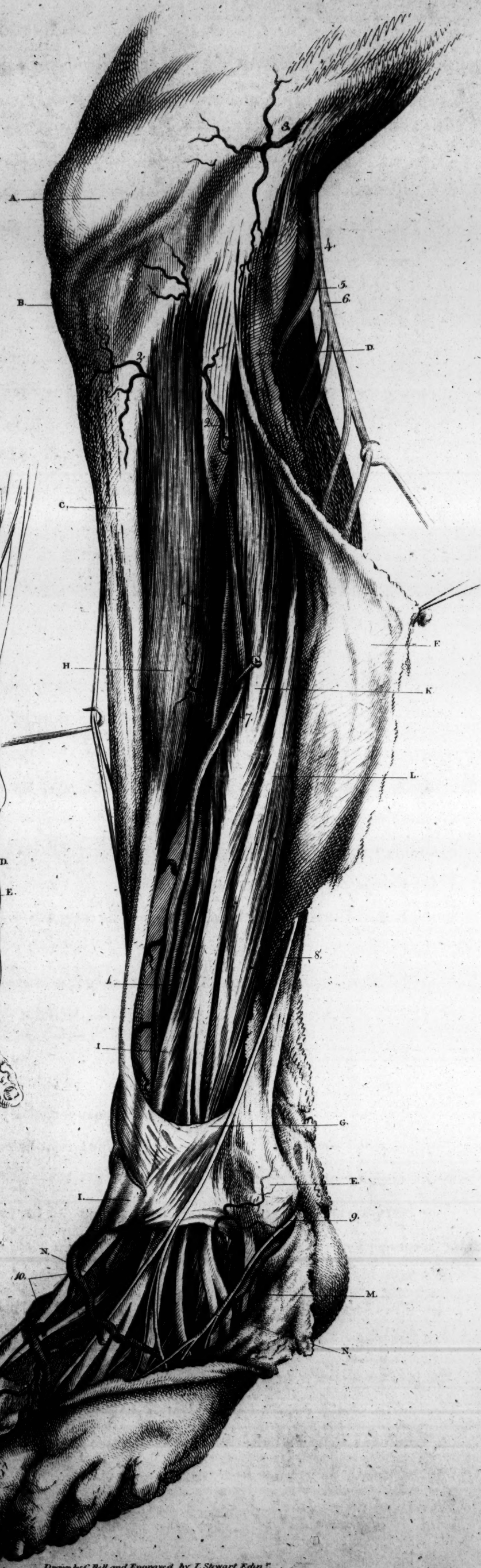
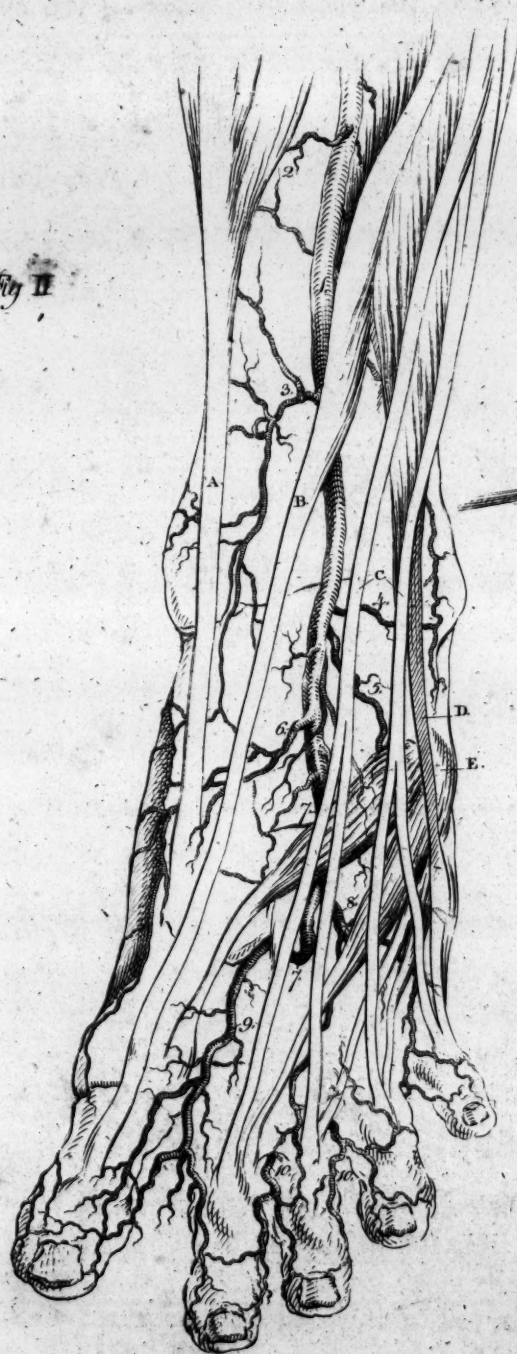


Fig II





DISTRIBUTION OF THE ARTERY.

- 1, ANTERIOR TIBIAL ARTERY.
- 2, Muscular branches.
- 3, INTERNAL MALEOLAR ARTERY.
- 4, EXTERNAL MALEOLAR ARTERY—it inosculates with the fibular and tarsal arteries.
- 5, The TARSAL ARTERY distributed to the bones and joints of the tarsus, and to the extensor brevis—it sometimes gives off the interosseous arteries.
- 6, Branch to the inside of the foot, and to the muscles of the great toe; it inosculates with other branches of the anterior tibial artery, and with the plantar artery.
- 7, 7, The termination of the trunk of the anterior tibial artery going down by the metatarsal bone of the great toe into the sole of the foot.
- 8, The metatarsal artery giving off the interossei.
- 9, Arteria dorsalis pollicis.
- 10, Branches of the plantar artery to the toes.

END OF VOLUME THE FIRST.

DIRECTIONS FOR THE BINDER.

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